Northeast Fisheries Science Center Reference Document 04-12

Description of the 2003 Oceanographic Conditions on the Northeast Continental Shelf

by

Cristina Bascuñán, Maureen H. Taylor,
and James P. Manning

September 2004

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Abstract

A summary of hydrographic observations for 11 surveys on the northeast continental shelf during 2003 is presented. Distributions of CTD stations, surface and bottom temperature, salinity, and anomalies are portrayed. The average surface and bottom temperatures and salinities have been calculated in five geographic regions over the northeast continental shelf: western Gulf of Maine (GOMW), eastern Gulf of Maine (GOME), Georges Bank (GB), northern Middle Atlantic Bight (MABN) and southern Middle Atlantic Bight (MABS). Time series plots from various shipboard environmental sensors are included if available.

Hydrographic data collected during 2003 were sorted into six 2-month time bins to provide broad bimonthly coverage used in the averaging method. Review of the computed areal average temperature and salinity data indicates that temperatures showed a fairly typical seasonal pattern. Salinities were found to be similar to the MARMAP reference period with the exception of surface salinity in the southern MAB.

Introduction

The Northeast Fisheries Science Center (NEFSC) conducts several different surveys off the northeast continental shelf each year. Complete coverage of the shelf (Cape Hatteras to the Gulf of Maine) occurs during the spring and fall bottom trawl surveys and during some of the Ecosystem Monitoring cruises. Station coverage on other cruises throughout the year varies.

Temperature and salinity observations from 11 NEFSC surveys conducted during 2003 are summarized and presented in this report. Cruise operation summaries are presented for all cruises. Distribution plots of surface and bottom temperature, salinity, and anomalies are contoured where sufficient data are available. Areal average temperature and salinity and the

corresponding anomalies also are presented for the five different regions on the shelf and for 6 time periods throughout the year. Contour maps are presented chronologically in an atlas form. Environmental data from the SCS (Ship-board Computing System) are presented as time series figures for each leg of a cruise. No attempt has been made here to rigorously analyze the data or discuss in detail individual observations from the cruises.

Data and Methods

Temperature and salinity measurements were obtained with a Seabird (SBE) model 19 profiling CTD (Profiler), which measures the pressure, temperature and conductivity of the water twice per second. Two different methods of deployment were used depending upon the type of work conducted at a station (See Taylor and Bascuñán, 2000). Whenever a plankton haul was done, the Profiler was placed above the bongo nets (sensors facing up), and a double oblique tow was made. Upcast data are used as the primary data when the Profiler is deployed with bongo nets. The turbulence generated by the bongo nets during the downcast adversely affects both the temperature and conductivity data quality. If no plankton haul was done, the Profiler was deployed vertically (sensors facing down) through the water column and the downcasts are processed as the primary data. Salinity samples are taken from the bottom of a vertical profile cast, generally twice per day, in order to determine a salinity correction or offset for the data. These samples are analyzed on shore using a Guildline Autosal Salinometer maintained at the NEFSC Narragansett laboratory.

On two ECOMON cruises, DEL0305 and ARM0301, a fluorometer was used on the CTD instrument. No special processing of the data was performed and only the raw fluorometer voltage values are presented.

During the deep-water systematics cruise, DEL0304, hydrographic data were collected using an Applied Microsystems CTD 12+ that was placed in a protective tube and attached to the trawl net. These data were collected as part of an ongoing instrument evaluation conducted by the Oceanography Branch with the goal of being able to deploy a CTD instrument from a non-traditional platform (i.e., on fishing trawl nets). There was very little quality control of these data, other than checking for water column stability, since it was not possible to take salinity samples. The project description, cruise notes, and processed data may be downloaded from: ftp://ftp.wh.whoi.edu/pub/hydro/cruise_rpts/2003/DEL0304_ctd.html.

All raw Profiler data were processed using the Seabird software: DATCNV, FILTER, ALIGNCTD, BINAVG, DERIVE, and ASCIIOUT to produce 1 decibar averaged ASCII files. The data were quality controlled and converted to a standard 80-column ASCII formatted cruise file and were archived in ORACLE tables and in the NEFSC anonymous FTP account (ftp://ftp.wh.whoi.edu/pub/hydro).

Station distributions and horizontal contour plots of the surface and bottom temperature, salinity, and temperature anomaly were prepared for each survey if coverage was sufficient. In addition, all the hydrographic data were combined and sorted into 2-month time bins. Areal average temperatures and salinities were then calculated for the six time periods and for the five regions of the northeast continental shelf shown in Figure 1a: western and eastern Gulf of Maine (GOMW, GOME), Georges Bank (GB), and the northern and southern Middle Atlantic Bight (MABN, MABS). Station distributions for each time period are shown in Figure 1b. Anomalies for the temperature and salinity observations were determined relative to reference values, using the method described by Holzwarth and Mountain (1990) as modified by Mountain et al. (2004). The areal averaging was also done using the method described in Holzwarth and Mountain

(1990) as modified by Mountain et al. (2004). The areal averages and anomalies were plotted against the calendar day mid-date of all observations within each of the six time periods. Areal averages and anomalies were also calculated by cruise and are listed in Tables C1 and C2 of Appendix C.

Results

The NEFSC cruises that are included in this report are listed in Table 1. A summary of each cruise is described in Appendix A and includes information on the type of cruise, its objectives, dates, the number of hydrographic stations, type(s) of instruments used, salinity calibration value, and notes pertaining to instrument performance. No salinity correction was applied to the cruise data if the mean salinity offset was less than +/- 0.01 psu.

Table 2 lists the surface and bottom areal average temperatures and temperature anomalies that were calculated for each of the five regions. Table 3 lists the surface and bottom areal average salinity and salinity anomalies for the same five regions. For most cruises, the areal averages and anomalies could not be calculated for all regions due to limited station coverage. Combining all the hydrographic data from all NEFSC programs and ships provided a better chance of adequate spatial and temporal coverage within the regions of the northeast continental shelf. When there was insufficient spatial coverage (see Holzwarth and Mountain, 1990), a simple average (not an areal weighted mean) was determined for the observations in the region; these values are indicated in Tables 2 and 3 by an asterisk. The standard deviations are also listed. SDV1 indicates how well the calculated anomaly represents the true regional average anomaly. SDV2 is an indicator of how closely the areal average matches the anomaly at any

particular location within that region (see Holzwarth and Mountain, 1990 for further explanation of SDV1 and SDV2).

Figures 2 - 3 present the time series of surface and bottom average temperature/salinity and temperature/salinity anomaly for each region. Cruises having less than 10 observations were not included in the time series figures. We were not able to resolve small-scale, localized events because of the regional averaging method used in this report. Station positions and distributions of surface and bottom temperature, salinity, and anomalies for the different cruises are presented in Figures 4 - 44. Contour distribution figures were not prepared for some of the cruises because of poor station coverage. In addition, contour levels were selected to highlight variability within a cruise and therefore the contour levels used may vary between cruises. Contour distributions have been routinely produced for the scallop survey although the station coverage for this survey does not provide sufficient spatial coverage to allow one to produce realistic broad-scale hydrographic distributions of the MAB and Georges Bank regions. Environmental time series plots from shipboard sensors (SCS data) are included in Appendix B. Further information about this data may be obtained at http://www.wh.whoi.edu/~jmanning/foi/alongtrack.html.

Discussion

The temperature anomaly time series (Figure 2) indicate that much of the northeast continental shelf experienced colder surface conditions for much of the first half of 2003 compared to the reference values. An exception to this occurred in the southern MAB with surface and bottom temperatures at the beginning of the year being slightly warmer than the reference. Salinities in the Gulf of Maine and Georges Bank were similar to the reference

period. In the southern MAB surface salinity anomalies were almost 1 ppt fresher than they were in 2002.

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Holzwarth, T.J. and D. Mountain. 1990. Surface and bottom temperature distributions from the Northeast Fisheries Center spring and fall bottom trawl survey program, 1963-1987. Woods Hole, MA: Northeast Fisheries Center. Reference Document 90-03. Available from: Information Services Section, NMFS/Northeast Fisheries Science Center, Woods Hole, MA 02543

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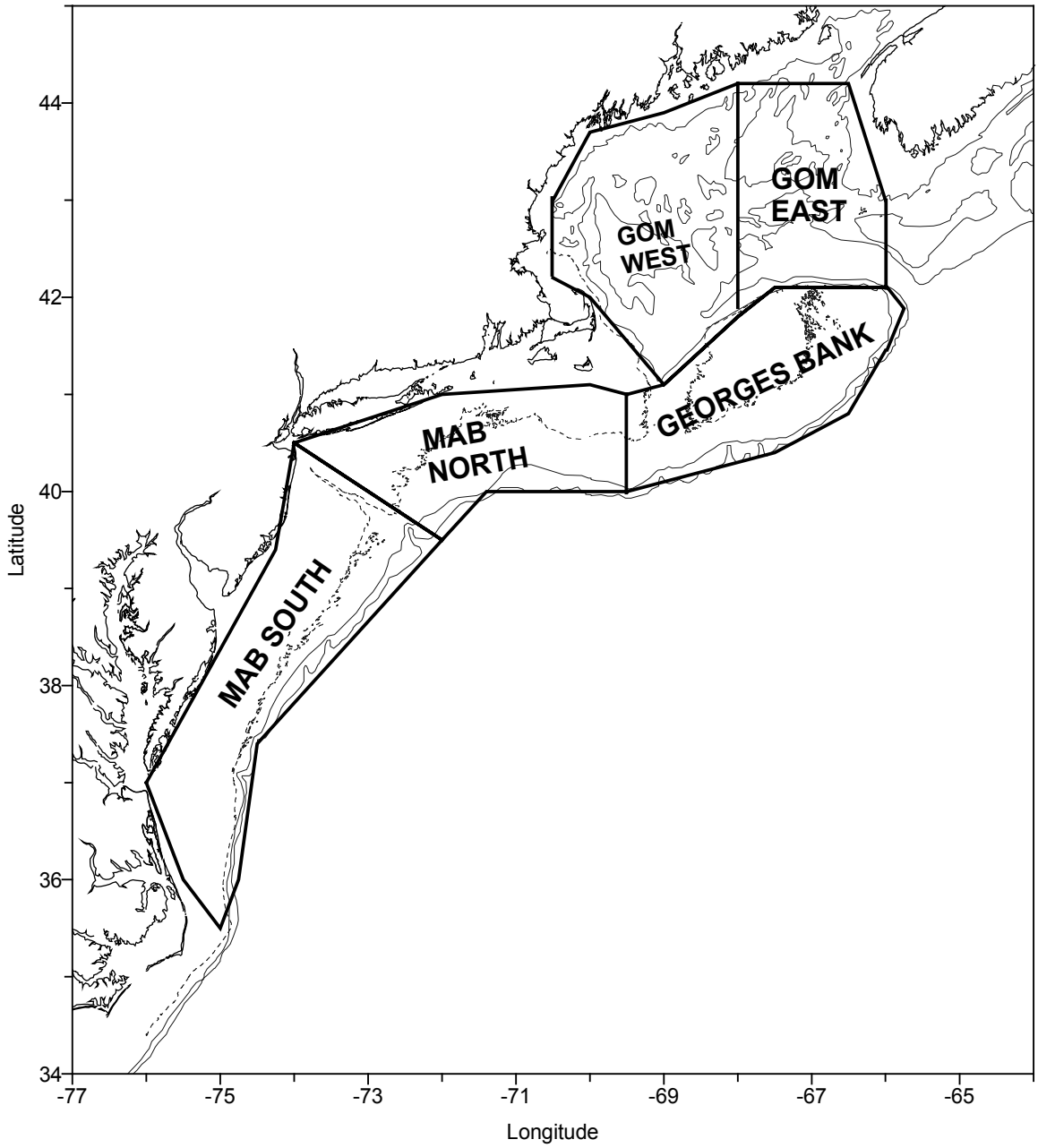


Figure 1a. The regions of the northeast continental shelf covered by the Northeast Fisheries Science Center cruises during 2003.

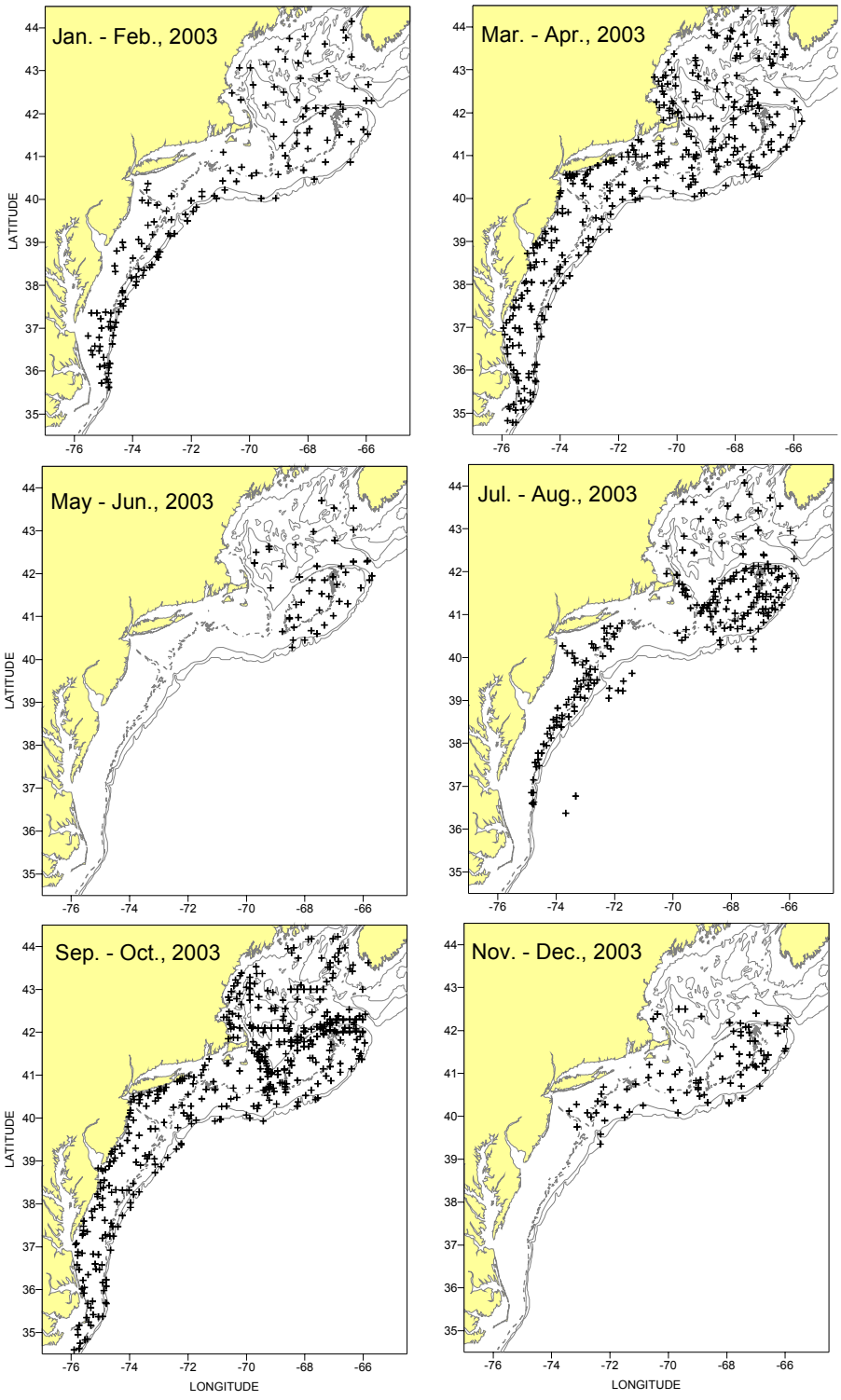


Figure 1b. Distributions of hydrographic stations occupied during 2003.

Table 1. Summary of 2003 Cruises.

Cruise	Program	Dates	Regions[1]
DEL0301	ECOMON Survey	23 – 31 January	GB, GOM
DEL0302	Winter Bottom Trawl	6 February – 1 March	GB, MAB
DEL0303	Spring Bottom Trawl	3 March – 27 April	GB, MAB, GOM
DEL0305	ECOMON Survey	24 – 29 May	GOM, GB
DEL0306	Cetacean Tagging	16 21 July	MAB, GB
ALB0301	Scallop Survey	2 July – 5 September	MAB, GB
ARM0301	ECOMON Survey	20 – 28 August	GB, GOM
DEL0308	Hydro Acoustic Survey	4 Sept – 10 Oct	GB, GOM
ALB0305	Fall Bottom Trawl	9 September – 31 Oct.	GB, GOM, MAB
DEL0310	Benthic Habitat	29 Oct. – 6 November	GOM, GB
ALB0306	ECOMON Survey	3 – 12 November	MAB, GB

[1] Regional Abbreviations:

GOM = Gulf of Maine
MAB = Mid-Atlantic Bight
GB = Georges Bank

Table 2. Areal average surface and bottom temperature and temperature anomalies presented in two month time periods using hydrographic data collected during 2003 in the five regions of the northeast continental shelf.

	SURFACE					BOTTOM				
Region	#obs	Temp	Anomaly	SDV1	SDV2	#obs	Temp	Anomaly	SDV1	SDV2 (1)
January - February										
GOMW	22	4.76	-1.25	0.24	1.24*	19	7.06	0.58	0.23	1.07*
GOME	16	3.37	-2.00	0.25	1.14	10	6.87	-0.17	0.34	1.27*
GB	23	4.87	-0.67	0.24	.54*	20	5.22	-0.75	0.23	1.01*
MABN	20	4.97	-0.52	0.45	1.10*	12	4.05	-1.20	0.50	2.28*
MABS	58	6.85	0.55	0.26	1.76	45	6.72	0.47	0.32	2.01
March - April										
GOMW	53	4.85	-0.61	0.19	0.73	51	5.07	0.00	0.15	0.78
GOME	33	3.64	-1.06	0.20	0.65	28	6.41	-0.19	0.23	0.87
GB	54	4.41	-0.59	0.21	0.93	47	4.66	-0.36	0.20	0.94
MABN	62	5.10	0.53	0.29	0.74	58	4.30	-1.45	0.33	2.00
MABS	73	6.38	0.51	0.25	1.71	67	5.85	0.02	0.29	1.95
May - June										
GOMW	11	8.92	-0.83	0.38	.80*	9	5.98	-0.01	0.31	.42*
GOME	14	6.68	-1.06	0.27	0.91	13	7.33	0.20	0.35	0.83
GB	31	8.50	0.02	0.24	2.01	29	8.01	0.51	0.28	1.70
MABN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MABS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
July - August										
GOMW	40	17.33	1.35	0.24	1.48	32	6.72	-0.21	0.21	1.62
GOME	27	14.97	0.46	0.21	2.03	17	8.62	-0.26	0.28	2.55
GB	87	17.89	1.89	0.16	1.94	74	10.91	-1.02	0.19	1.98
MABN	20	22.55	2.36	0.35	2.02*	20	9.39	0.91	0.33	1.46*
MABS	54	23.00	-0.35	0.24	2.29*	54	7.89	-0.05	0.29	1.36*
September - October										
GOMW	102	13.58	0.63	0.15	1.66	101	7.04	-0.03	0.11	1.58
GOME	84	13.04	0.29	0.17	1.13	78	8.59	0.05	0.17	1.87
GB	118	17.4	2.01	0.18	2.12	110	12.23	-0.17	0.21	2.18
MABN	62	20.57	1.74	0.26	1.93	54	12.86	1.16	0.29	2.75
MABS	80	21.28	0.48	0.25	1.22	72	15.03	0.89	0.28	2.18
November - December										
GOMW	5	10.04	0.15	0.56	.23*	3	6.68	0.24	0.52	.05*
GOME	8	11.72	-0.06	0.32	.64*	7	10.13	0.22	0.34	1.39*
GB	50	13.32	0.47	0.20	0.68	42	12.31	0.16	0.22	1.03
MABN	27	14.96	0.67	0.35	0.50	22	12.96	-0.13	0.41	1.00
MABS	5	15.96	1.10	0.67	.75*	4	13.90	1.40	0.72	2.17*

(1) "Region", the geographic region of the northeast continental shelf: "#obs", the number of observations included in each average: "Temp", the areal average temperature: "Anomaly", the areal average temperature anomaly: "SDV1", the standard deviation associated with the average temperature anomaly : "SDV2", the standard deviation of the individual anomalies from which the the average anomaly was derived.

(*) A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

Table 3. Areal average surface and bottom salinity and salinity anomalies presented in two month time periods using the hydrographic data collected during 2003 in the five regions of the northeast continental shelf

	SURFACE					BOTTOM				
Region	#obs	Salt	Anomaly	SDV1	SDV2	#obs	Salt	Anomaly	SDV1	SDV2 (1)
January - February										
GOMW	4	33.42	0.42	0.18	.10*	4	33.47	0.22	0.13	.17*
GOME	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GB	10	33.18	0.29	0.11	.14*	10	33.22	0.21	0.12	.28*
MABN	16	33.52	0.29	0.22	.33*	12	33.46	-0.04	0.17	.74*
MABS	53	34.08	0.46	0.15	0.52	44	34.18	0.5	0.12	0.36
March - April										
GOMW	38	32.67	0.19	0.10	0.55	51	33.32	-0.05	0.05	0.31
GOME	25	32.25	-0.24	0.12	0.41	28	33.79	-0.13	0.07	0.33
GB	48	32.45	-0.54	0.09	0.49	47	32.71	-0.41	0.07	0.41
MABN	60	32.90	0.03	0.13	0.55	57	33.22	-0.28	0.12	0.64
MABS	68	33.08	0.06	0.15	2.04	66	33.59	0.15	0.11	1.55
May - June										
GOMW	11	32.70	0.24	0.15	.30*	9	33.72	-0.06	0.10	.14*
GOME	14	32.38	0.00	0.16	0.23	13	33.93	0.08	0.11	0.20
GB	31	32.91	0.06	0.08	0.65	29	33.13	0.02	0.10	0.45
MABN	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MABS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
July - August										
GOMW	31	32.08	-0.04	0.11	0.23	26	33.46	0.03	0.08	0.18
GOME	27	32.53	0.08	0.10	0.28	17	34.10	0.16	0.09	0.32
GB	84	32.38	-0.29	0.06	0.35	73	32.88	-0.02	0.07	0.27
MABN	16	31.43	-0.45	0.18	.67*	20	33.28	0.25	0.12	.39*
MABS	51	31.33	-0.67	0.13	.58*	53	33.47	0.09	0.09	.48*
September - October										
GOMW	99	32.41	-0.02	0.07	0.22	100	33.64	0.04	0.04	0.24
GOME	83	32.75	0.18	0.09	0.31	78	34.37	0.19	0.06	0.26
GB	115	32.84	0.16	0.07	0.46	110	32.77	-0.18	0.08	0.33
MABN	61	32.70	0.20	0.11	1.49	54	33.16	-0.11	0.11	0.61
MABS	78	31.93	-0.39	0.14	1.36	72	32.77	-0.33	0.11	0.86
November - December										
GOMW	5	32.74	-0.05	0.21	.10*	3	34.03	0.03	0.12	.08*
GOME	8	32.71	0.09	0.13	.08*	7	34.03	0.47	0.12	.62*
GB	49	32.72	-0.01	0.07	0.16	42	33.01	0.03	0.08	0.40
MABN	27	33.03	0.03	0.15	0.52	22	33.77	0.27	0.15	0.44
MABS	5	33.34	0.14	0.33	.55*	4	33.82	0.44	0.24	.22*

(1) "Region", the geographic region of the northeast continental shelf: "#obs", the number of observations included in each average: "Salt", the areal average salinity: "Anomaly", the areal average salinity anomaly: "SDV1", the standard deviation associated with the average temperature anomaly : "SDV2", the standard deviation of the individual anomalies from which the the average anomaly was derived.

(*) A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

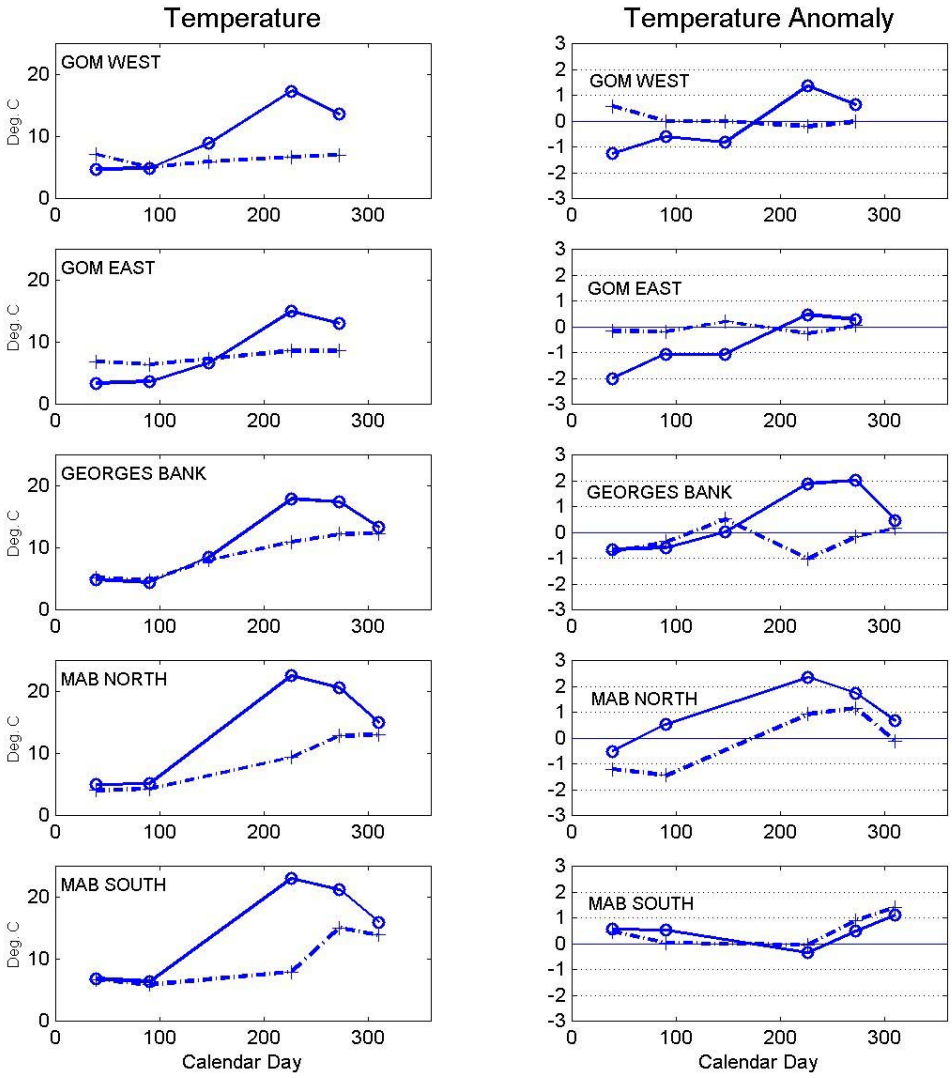


Figure 2. The 2003 areal average surface (-o) and bottom (--+) temperature and anomalies from Table 2.

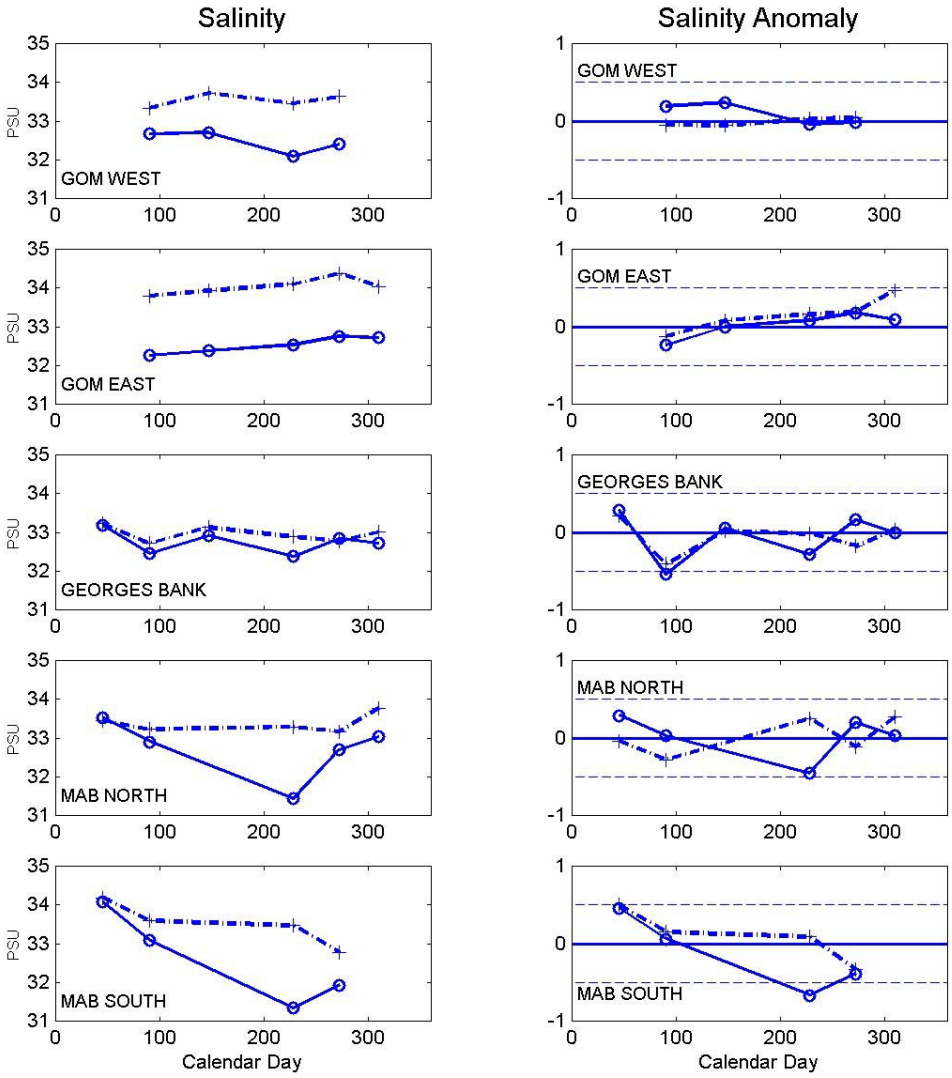


Figure 3. The 2003 areal average surface (-o) and bottom (--+) salinity and anomalies from Table 2.

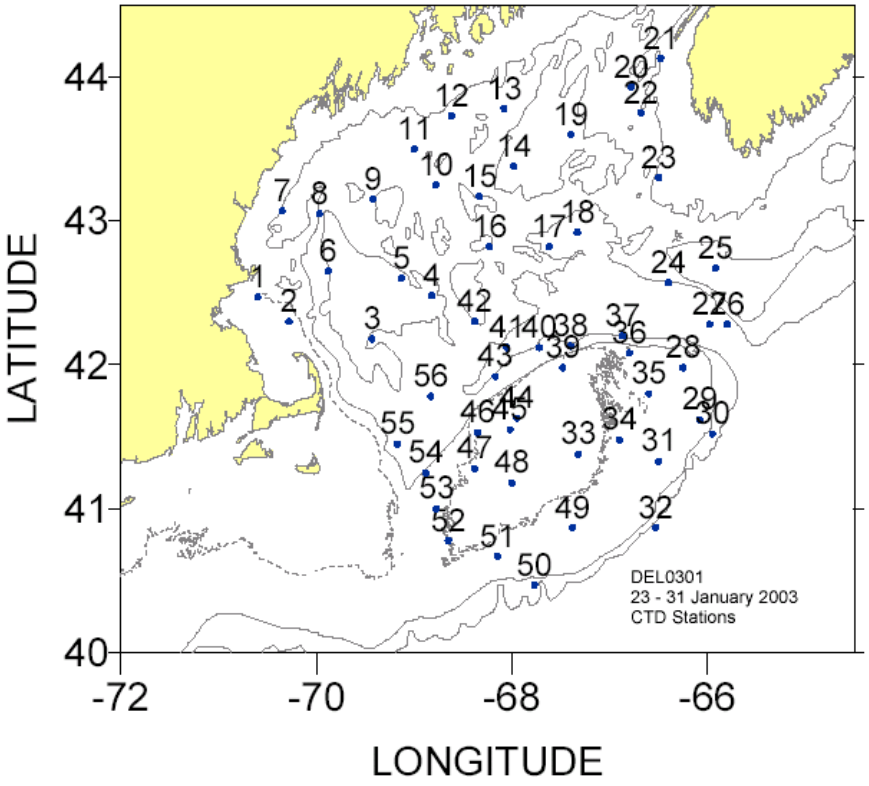


Figure 4. Hydrographic stations occupied during the ECOMON survey DEL0301.

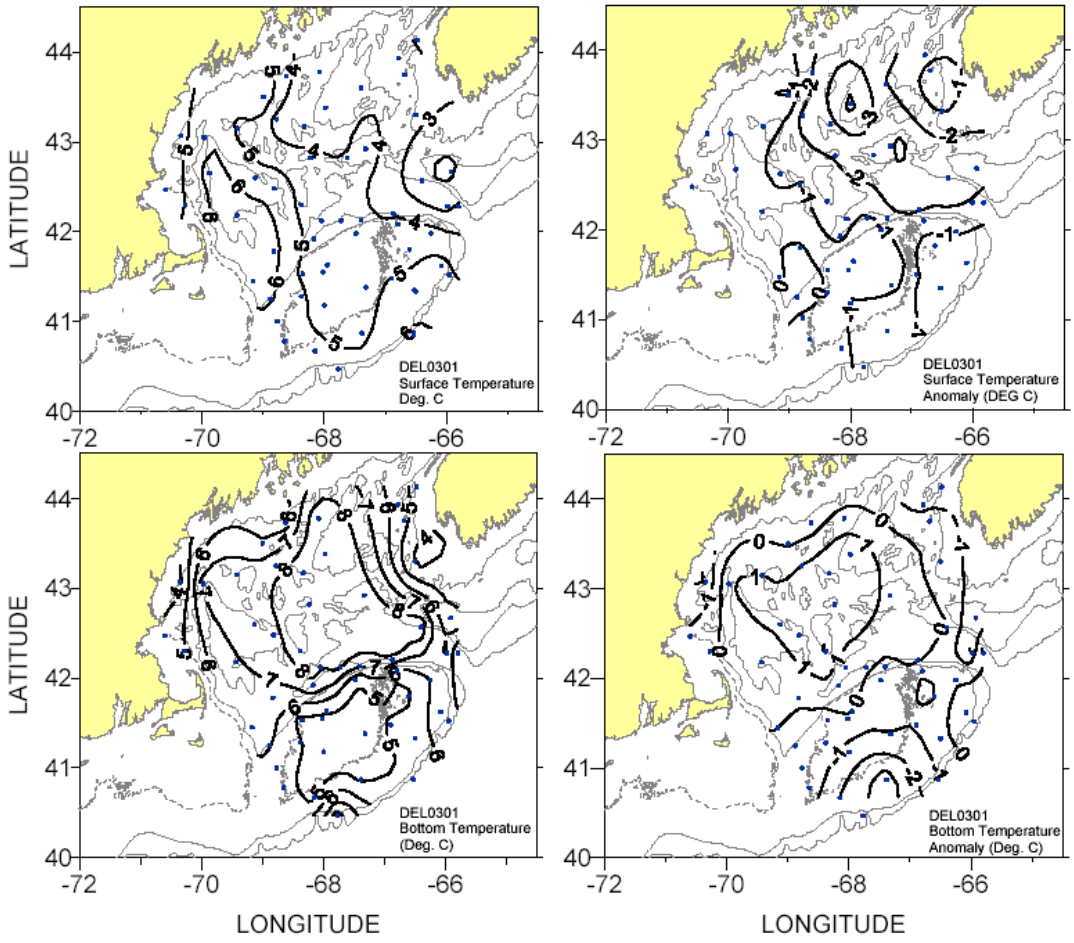


Figure 5. Surface and bottom temperature distributions and anomalies for the ECOMON survey DEL0301.

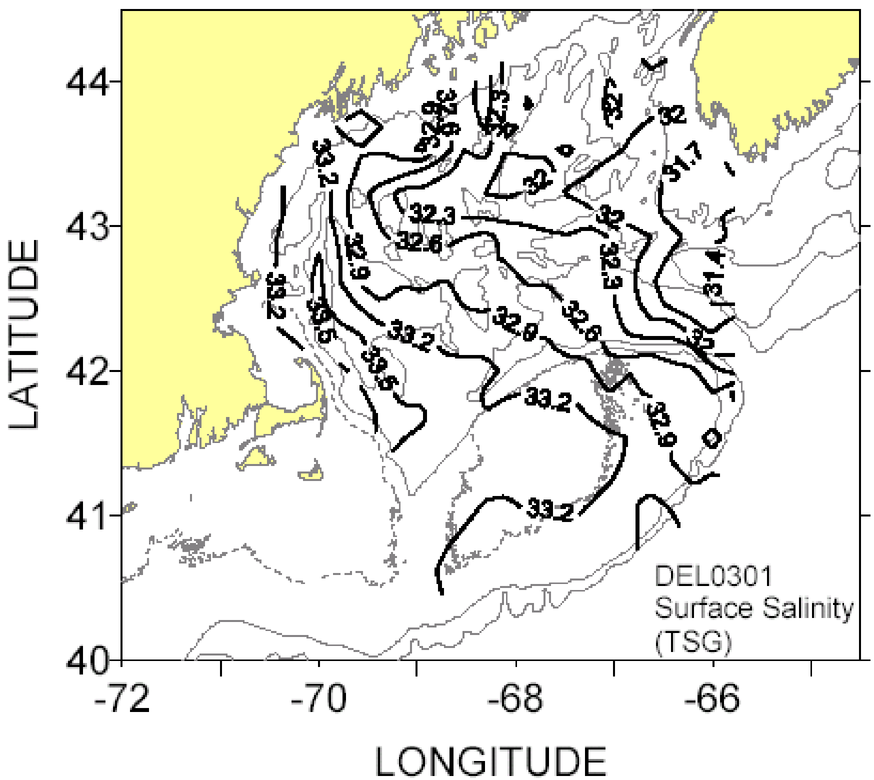


Figure 6. Surface salinity distribution for ECOMON survey DEL0301.

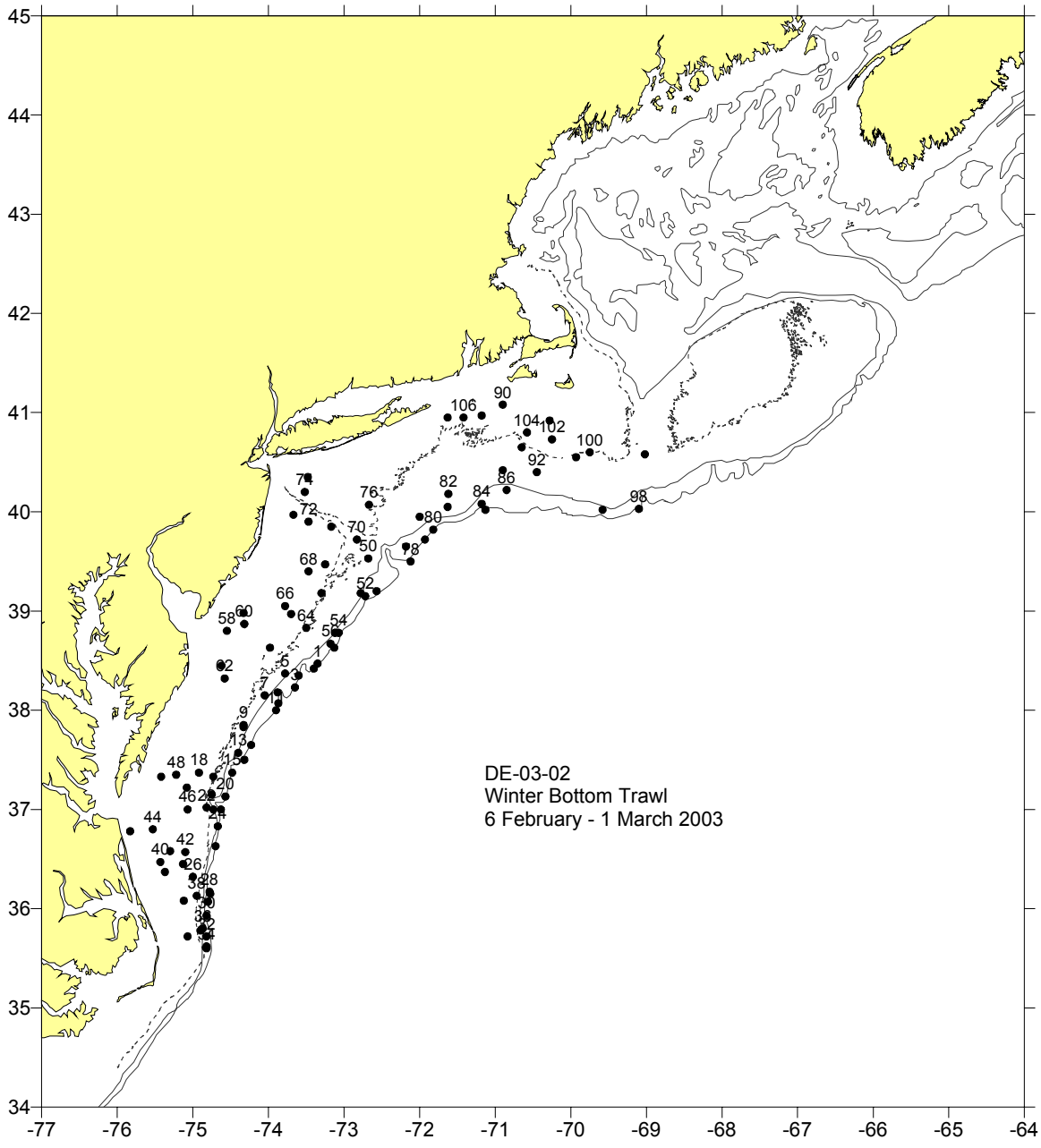


Figure 7. Hydrographic stations occupied during the Winter Bottom Trawl – DEL0302.

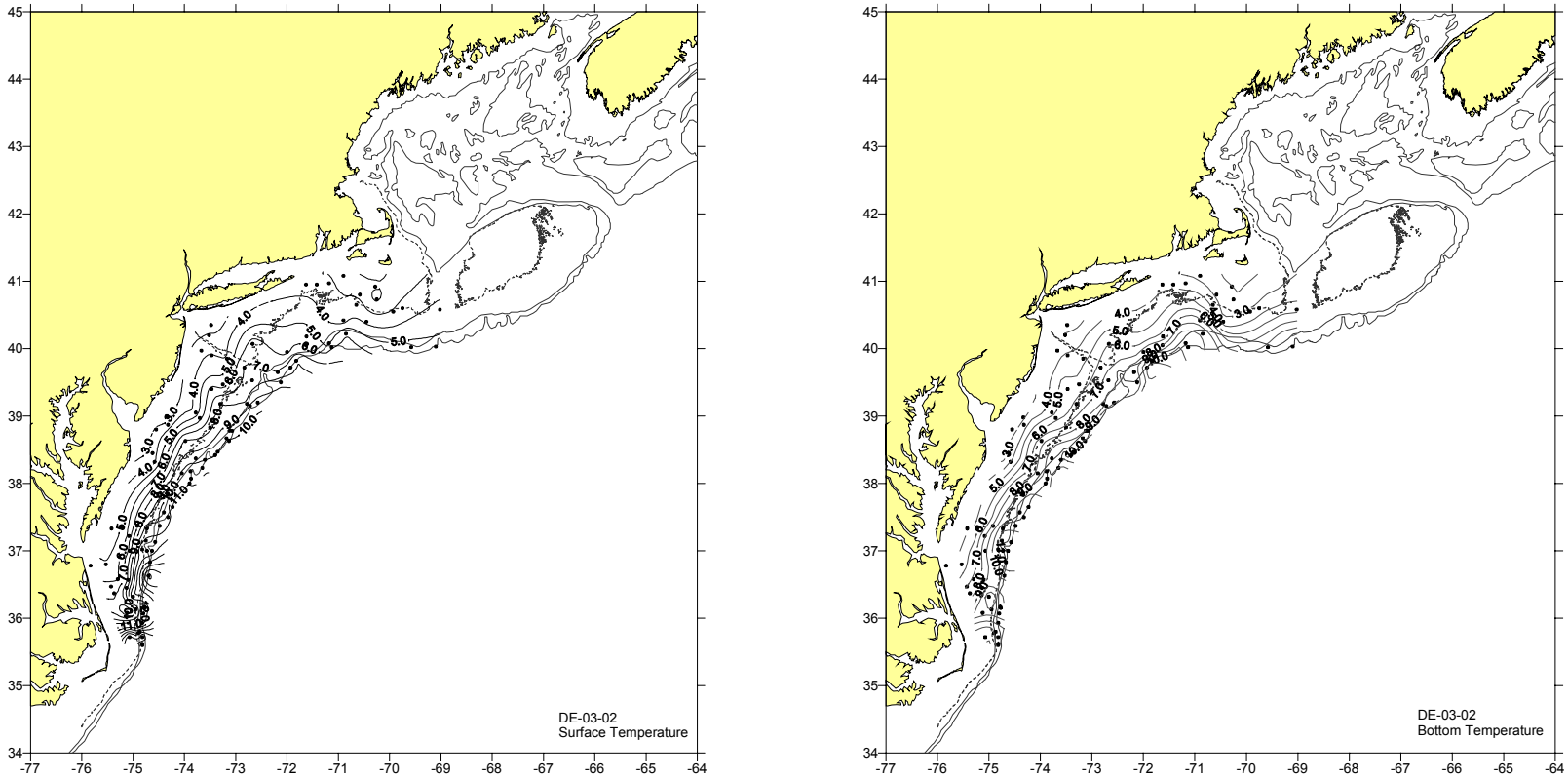


Figure 8. Surface and bottom temperature distributions for the Winter Bottom Trawl survey DEL0302.

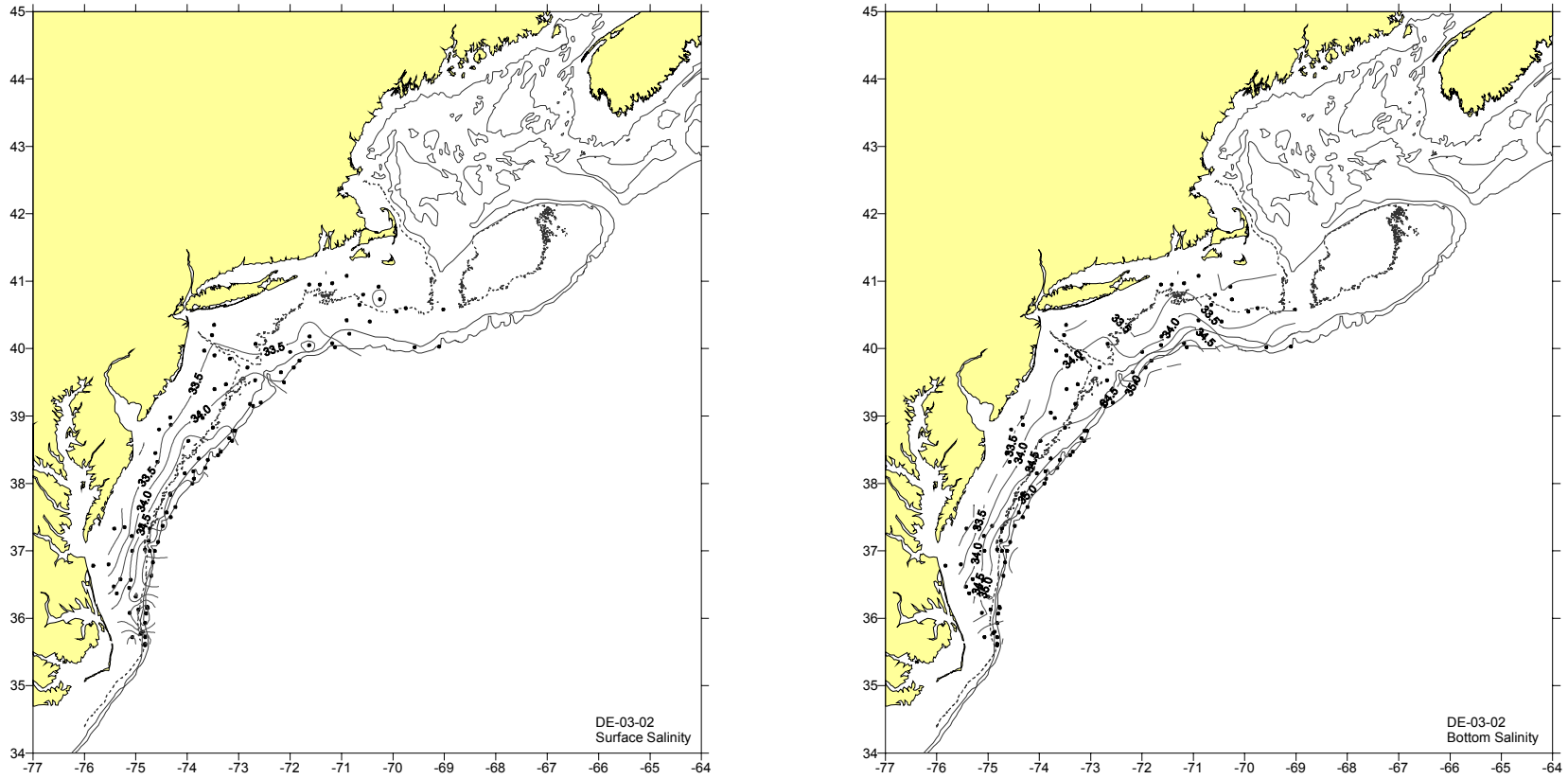


Figure 9. Surface and bottom salinity distributions for the Winter Bottom Trawl survey DEL0302.

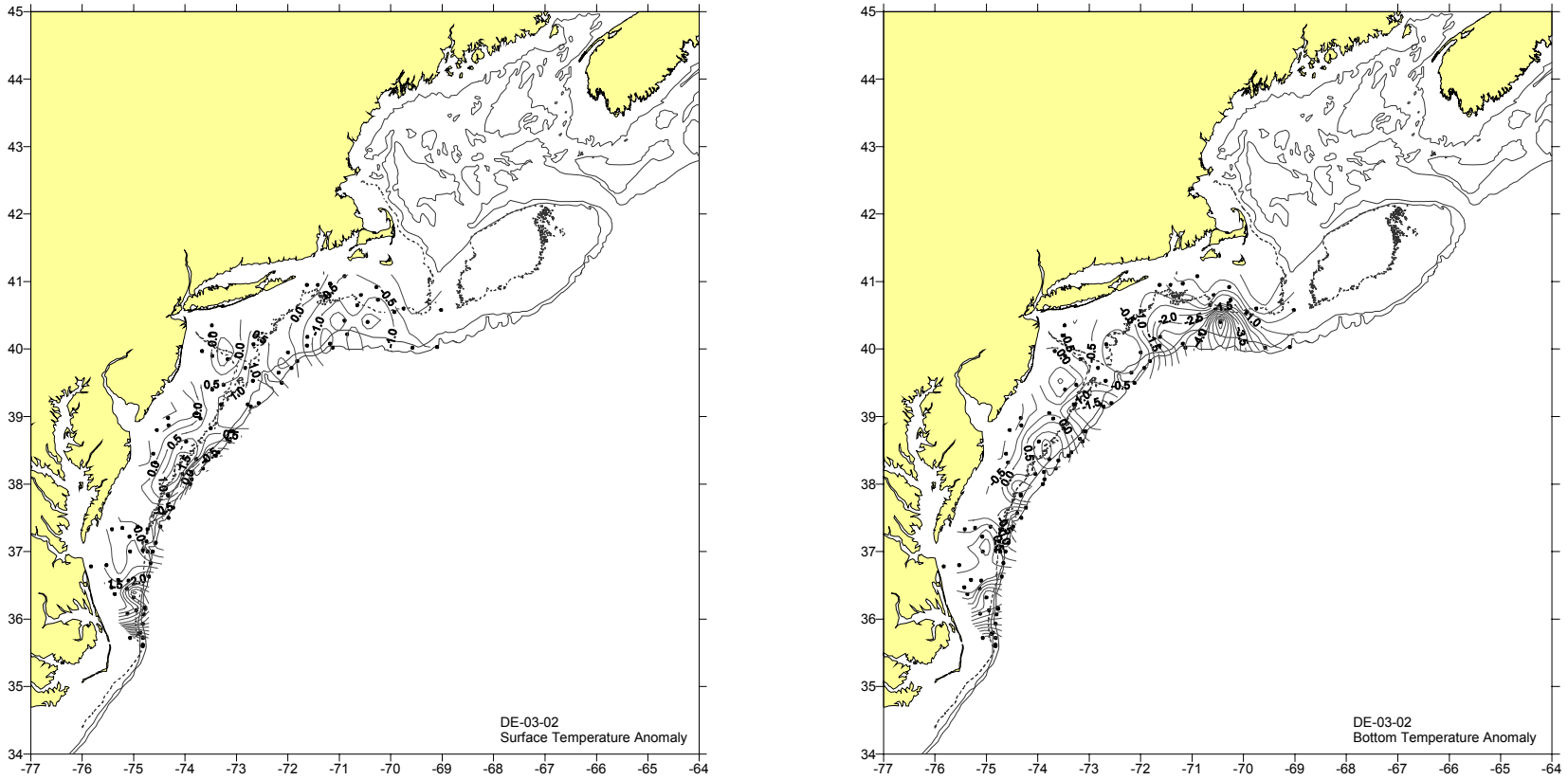


Figure 10. Surface and bottom temperature anomalies for the Winter Bottom Trawl survey DEL0302.

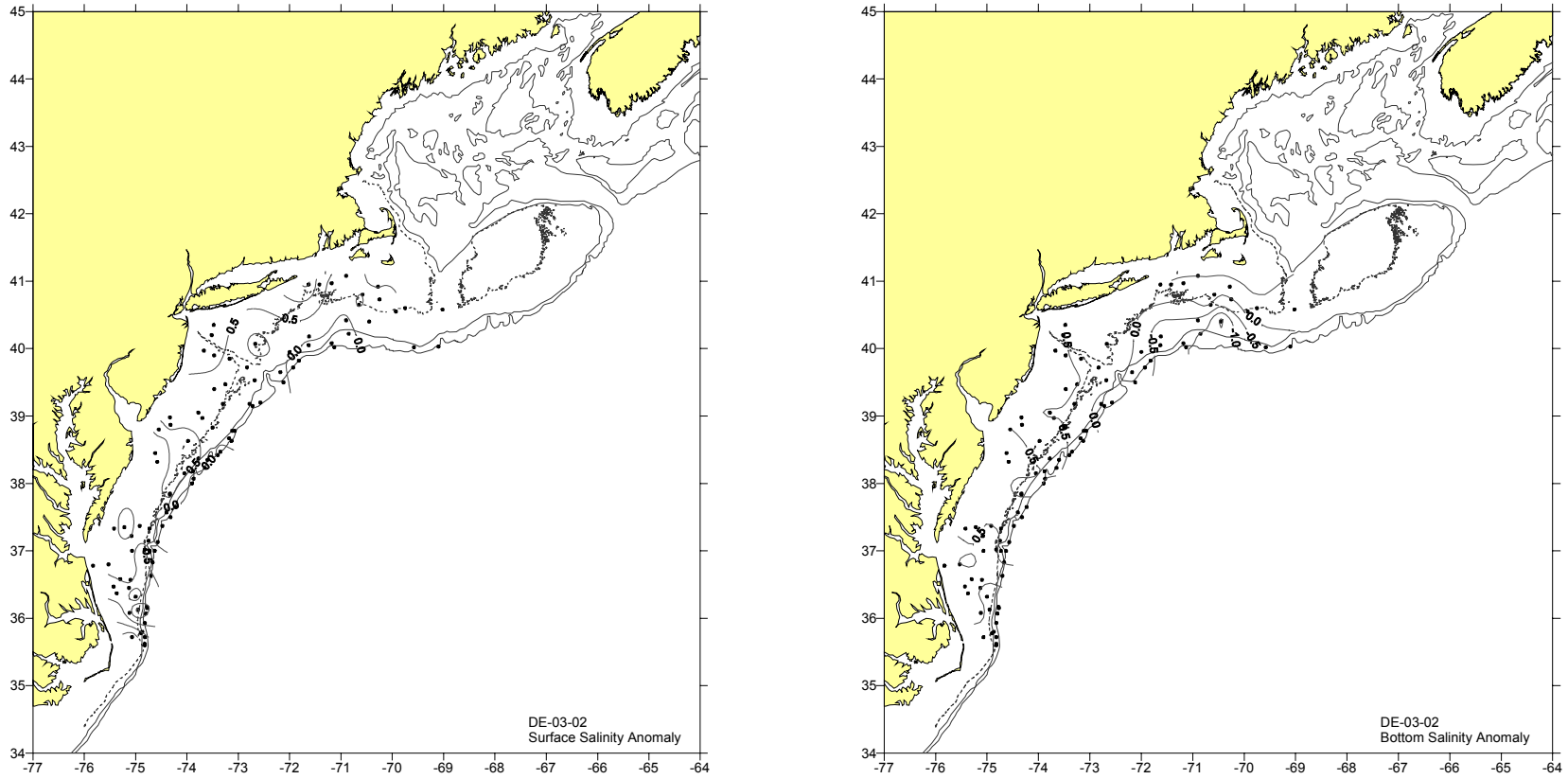


Figure 11. Surface and bottom salinity anomalies for the Winter Bottom Trawl survey DEL0302.

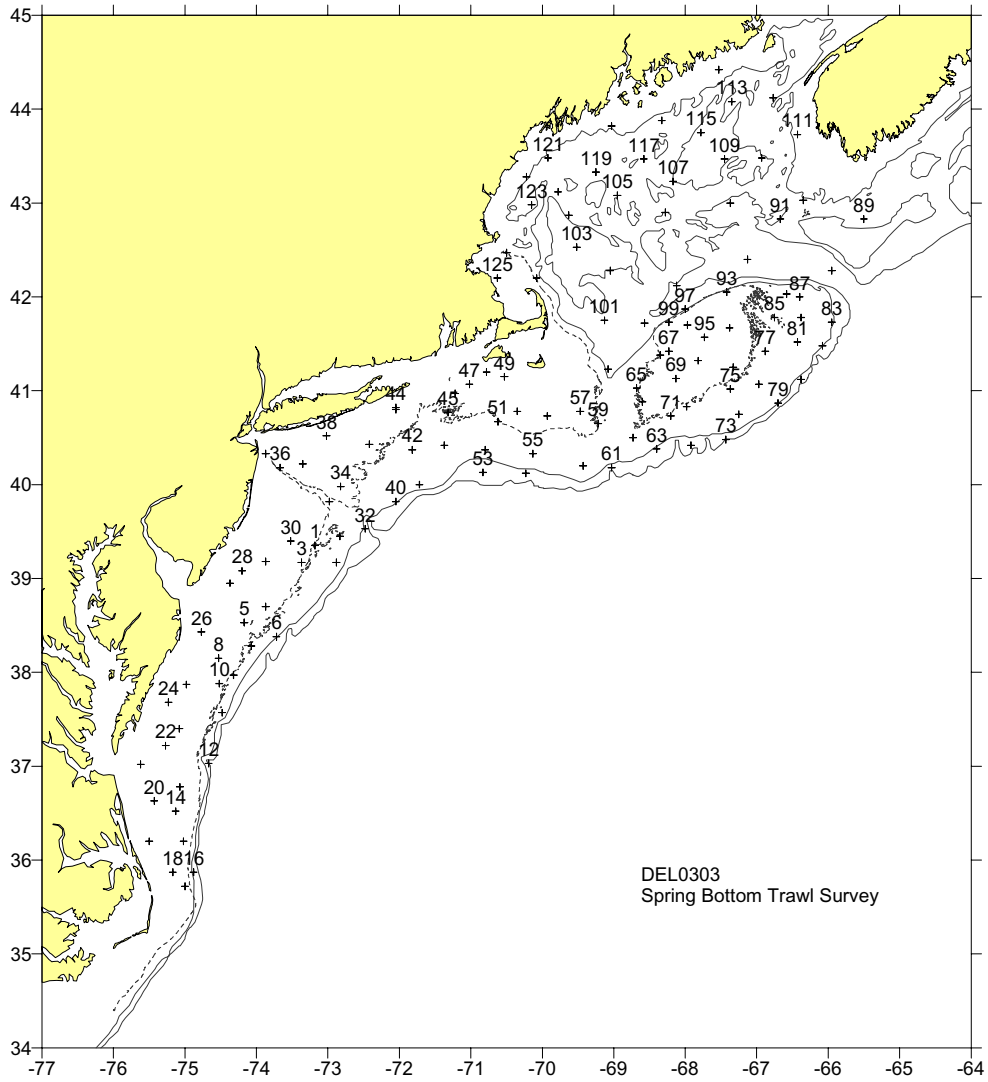


Figure 12. Hydrographic stations occupied during the Spring Bottom Trawl survey DEL0303.

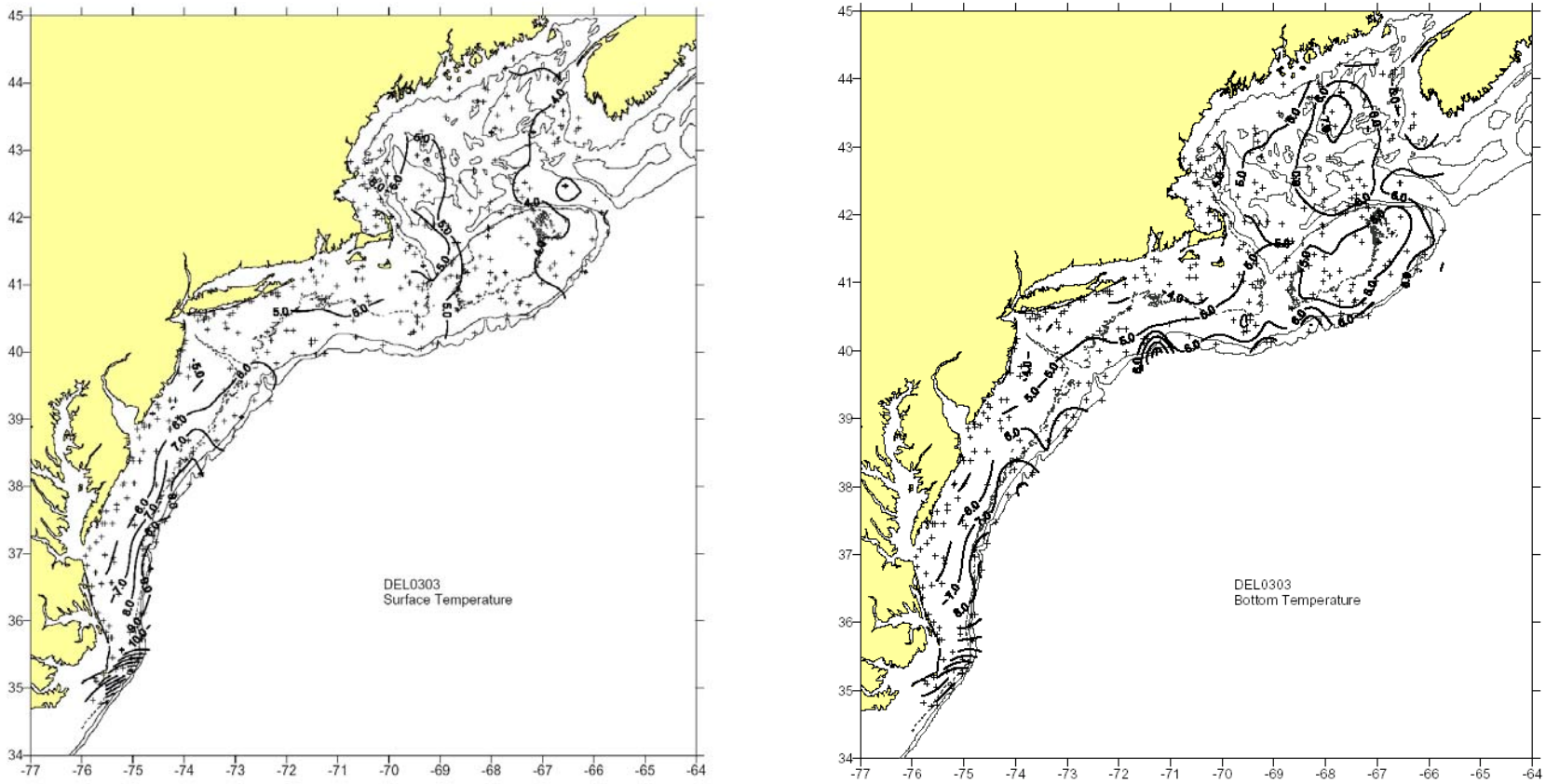


Figure 13. Surface and bottom temperature distributions for the Spring Bottom Trawl survey DEL0303.

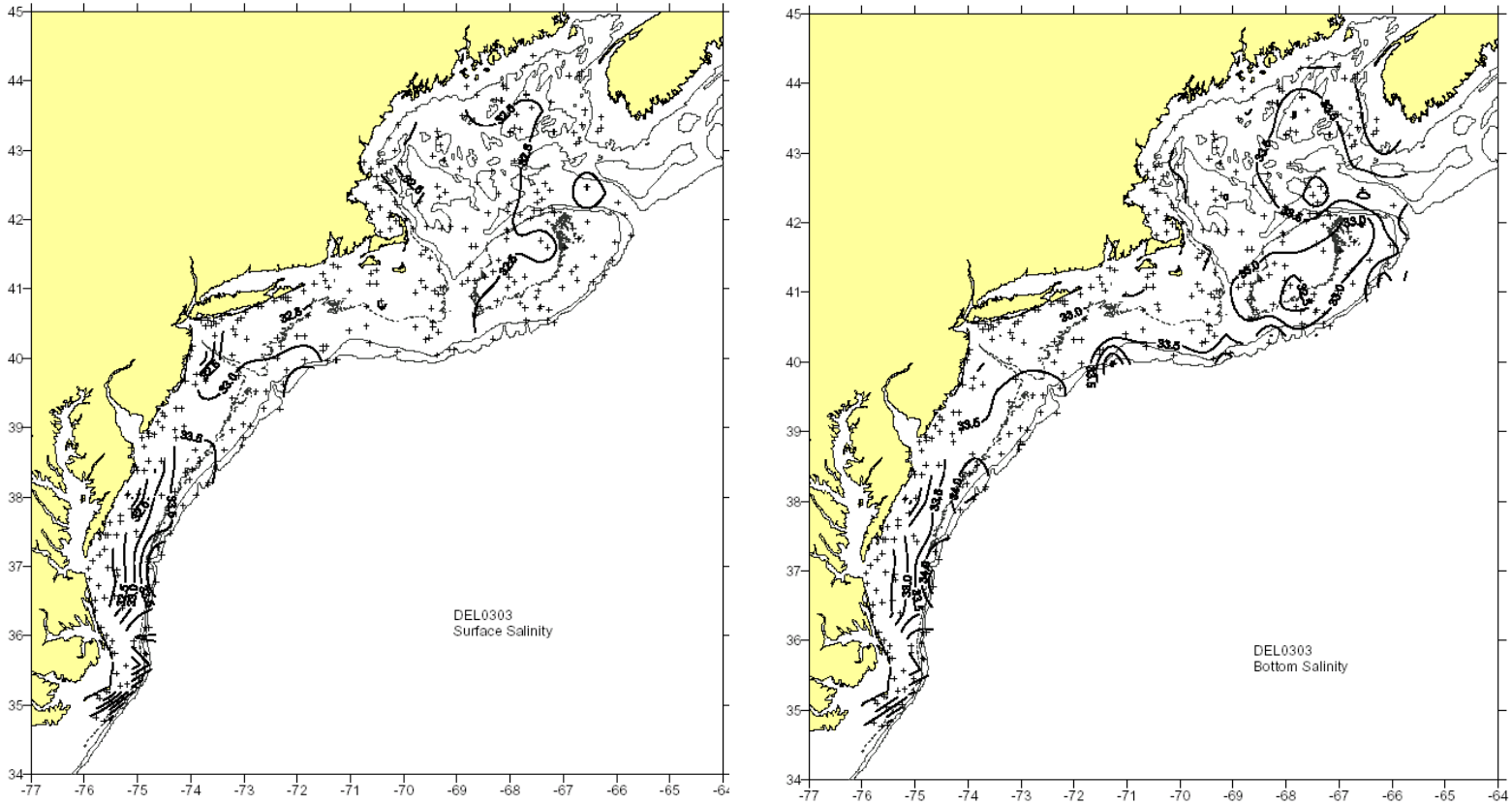


Figure 14. Surface and bottom salinity distributions for the Spring Bottom Trawl survey DEL0303.

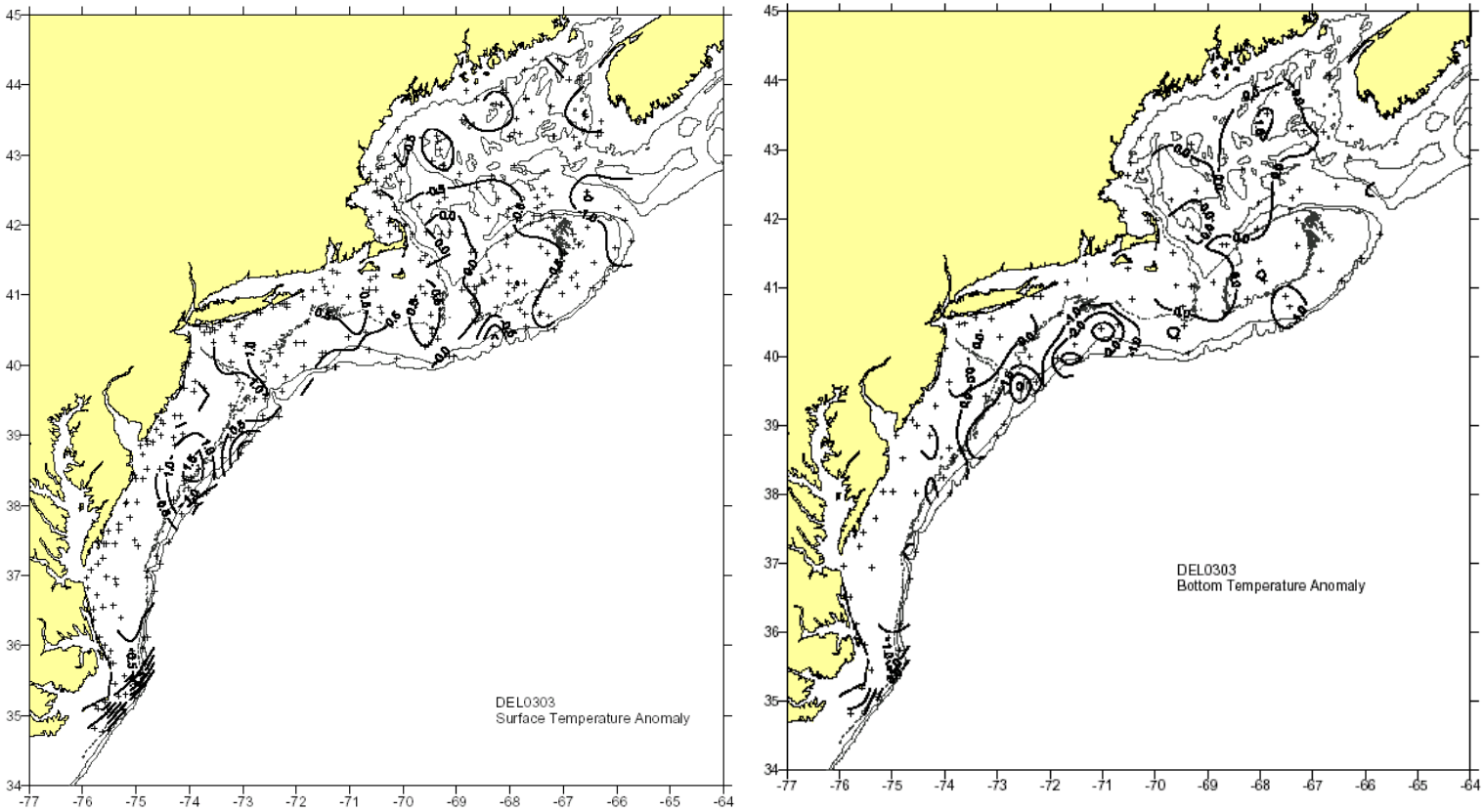


Figure 15. Surface and bottom temperature anomalies for the Spring Bottom Trawl survey DEL0303.

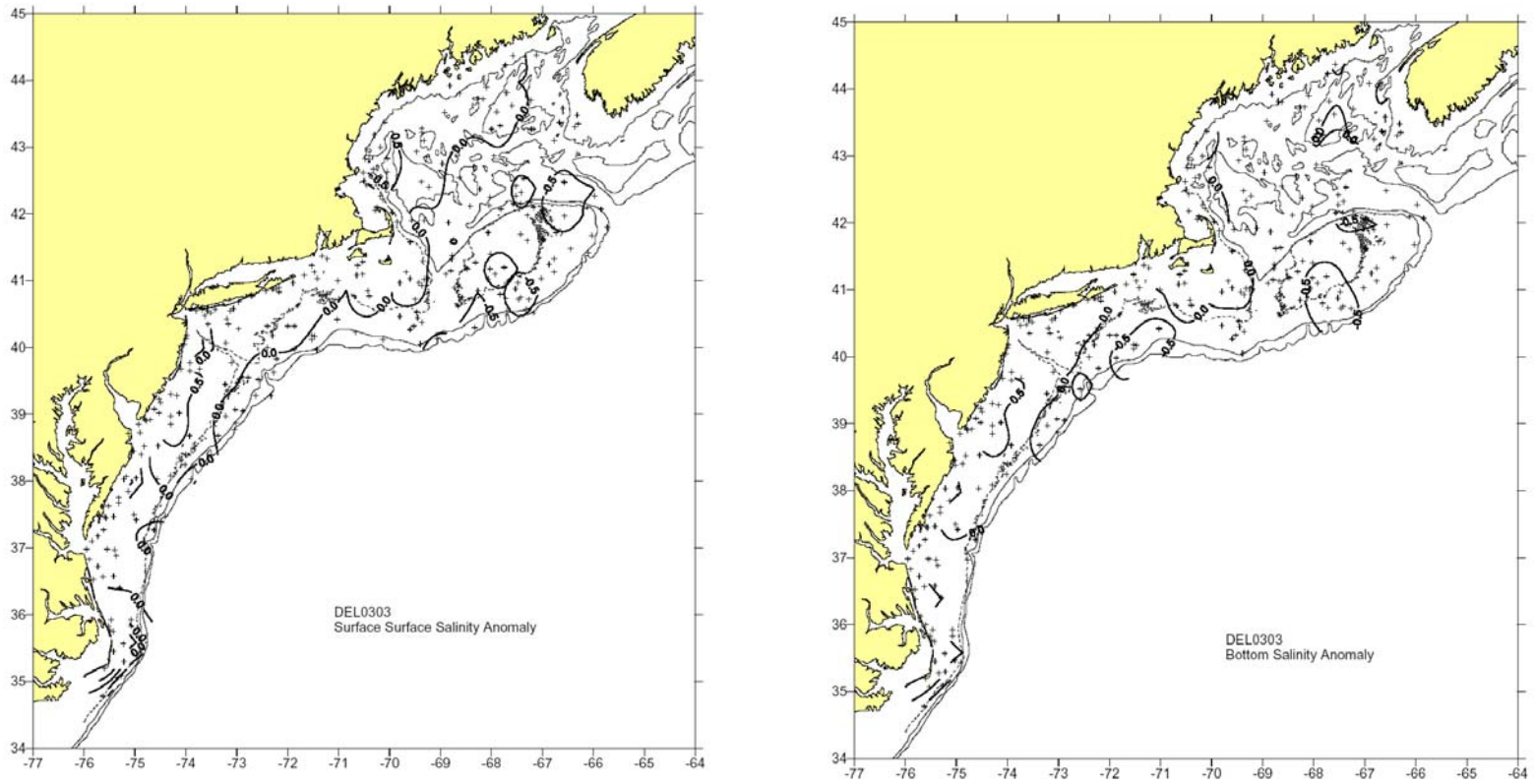


Figure 16. Surface and bottom salinity anomalies for the Spring Bottom Trawl survey DEL0303.

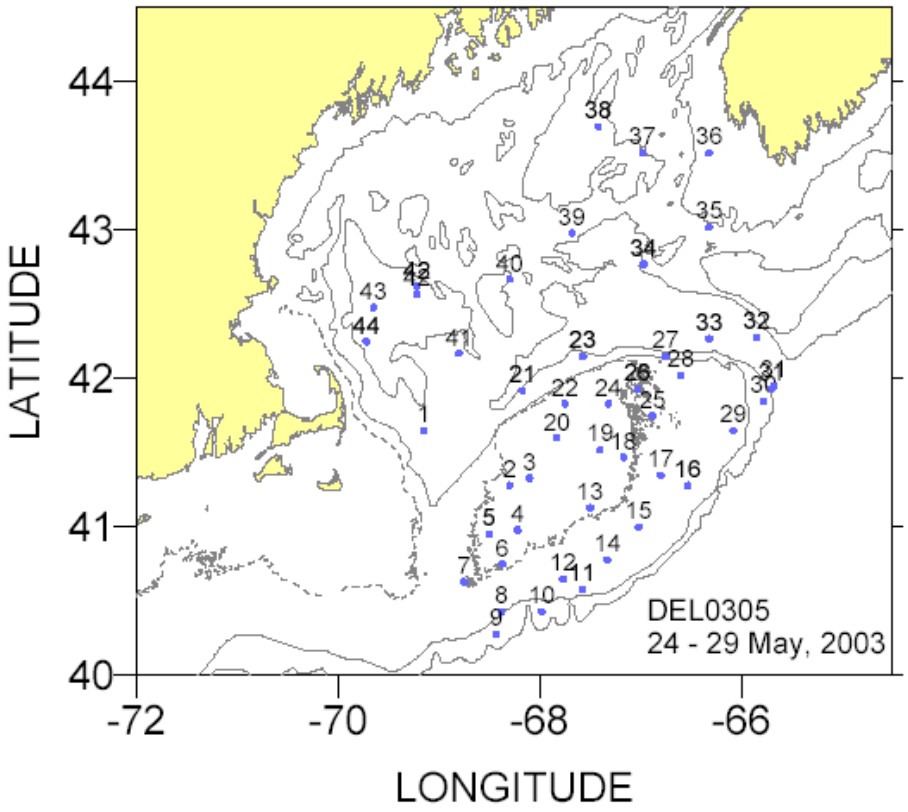


Figure 17. Hydrographic stations occupied during the ECOMON survey DEL0305.

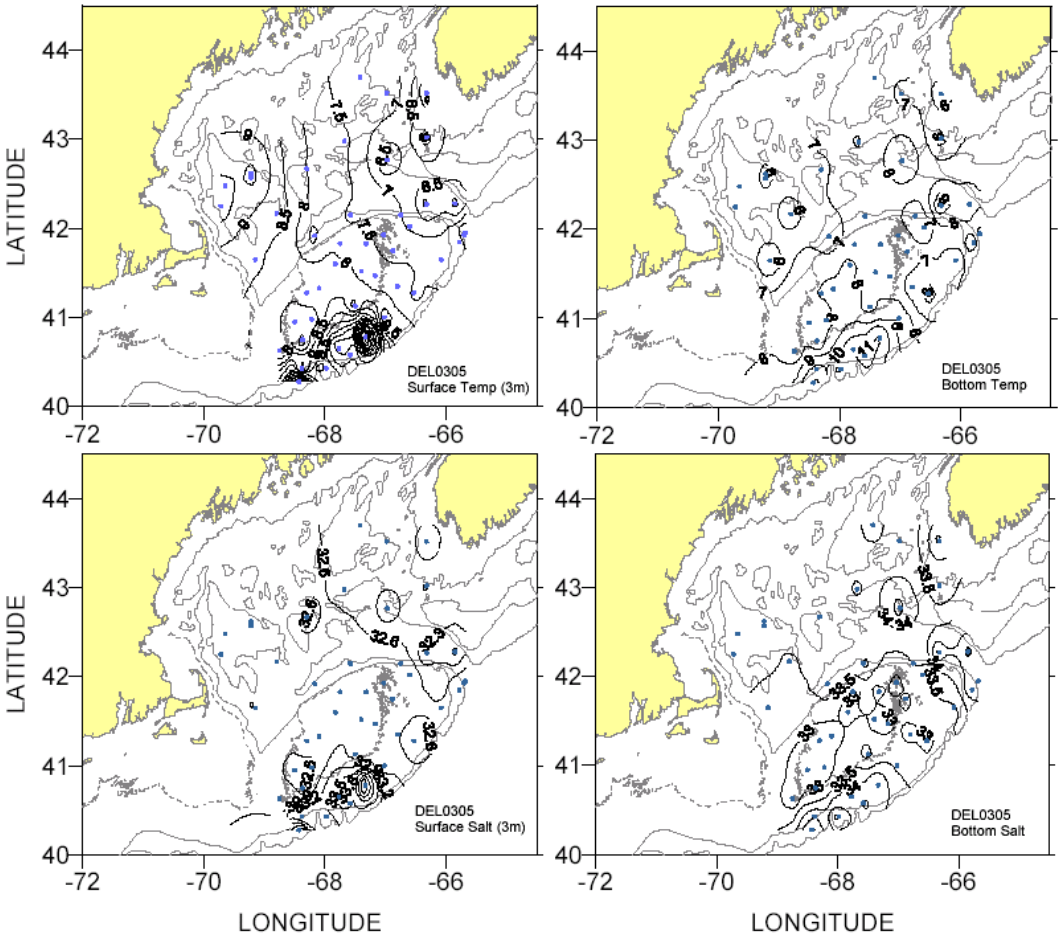


Figure 18. Surface and bottom temperature and salinity distributions the ECOMON survey DEL0305.

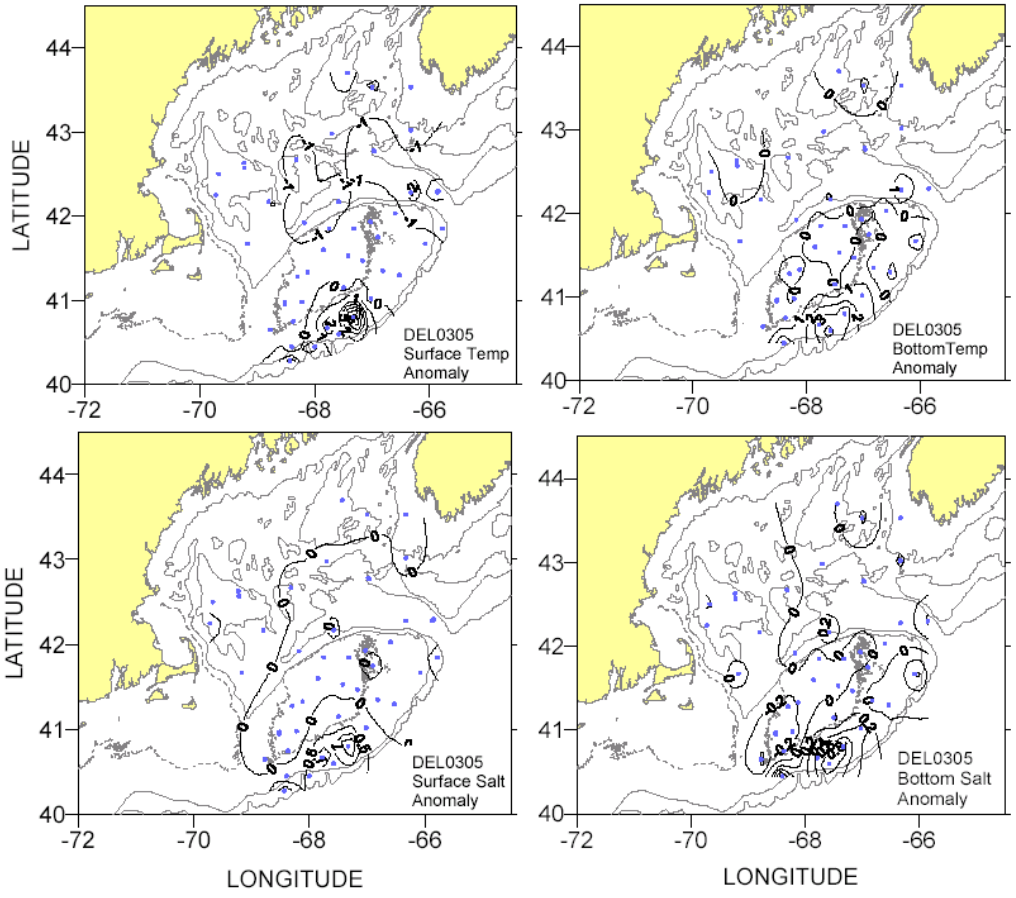


Figure 19. Surface and bottom temperature and salinity anomalies for the ECOMON survey DEL0305.

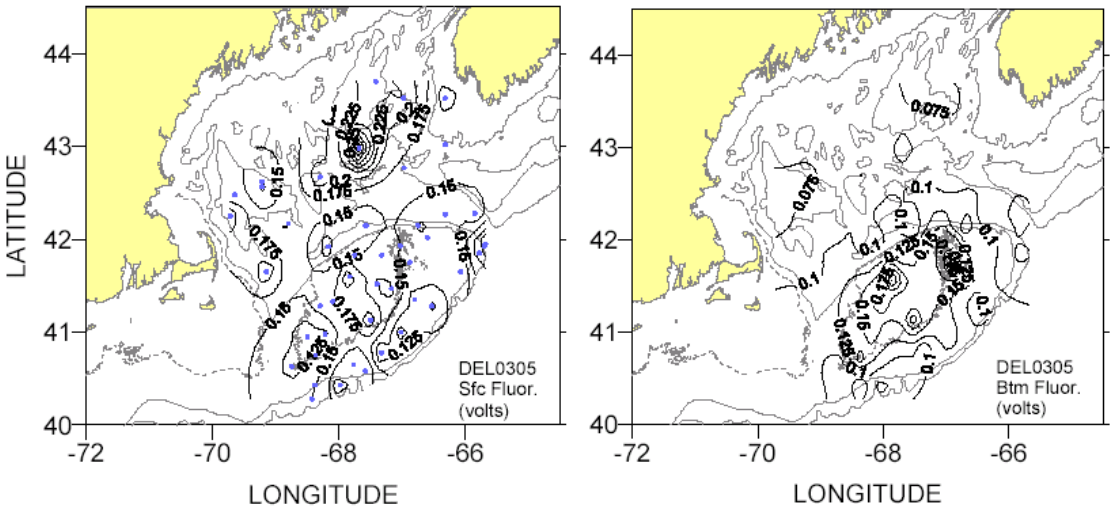


Figure 20. Surface and bottom fluorescence distributions for the ECOMON survey DEL0305.

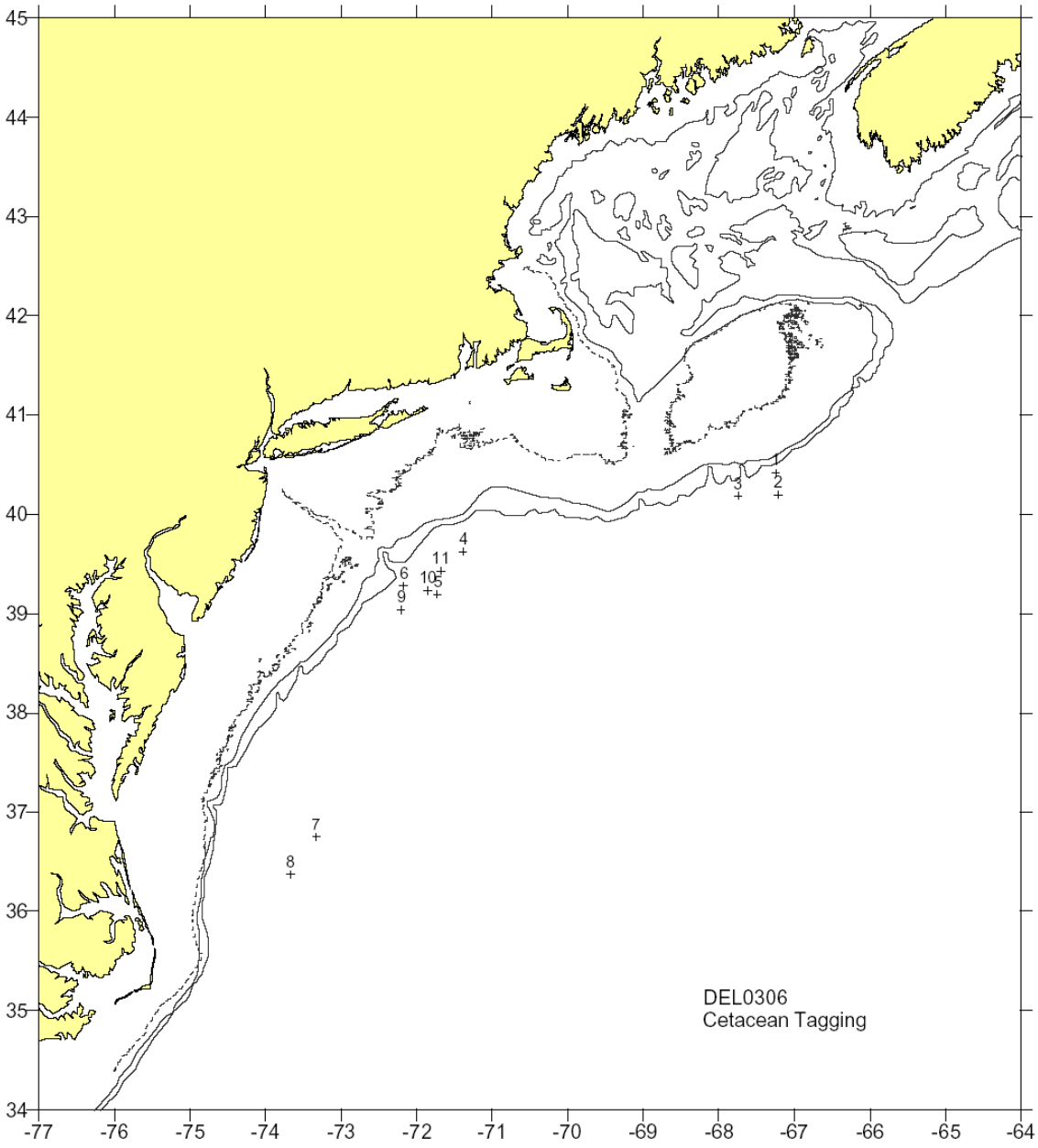


Figure 21. Hydrographic stations occupied during DEL0306 – Cetacean Tagging.

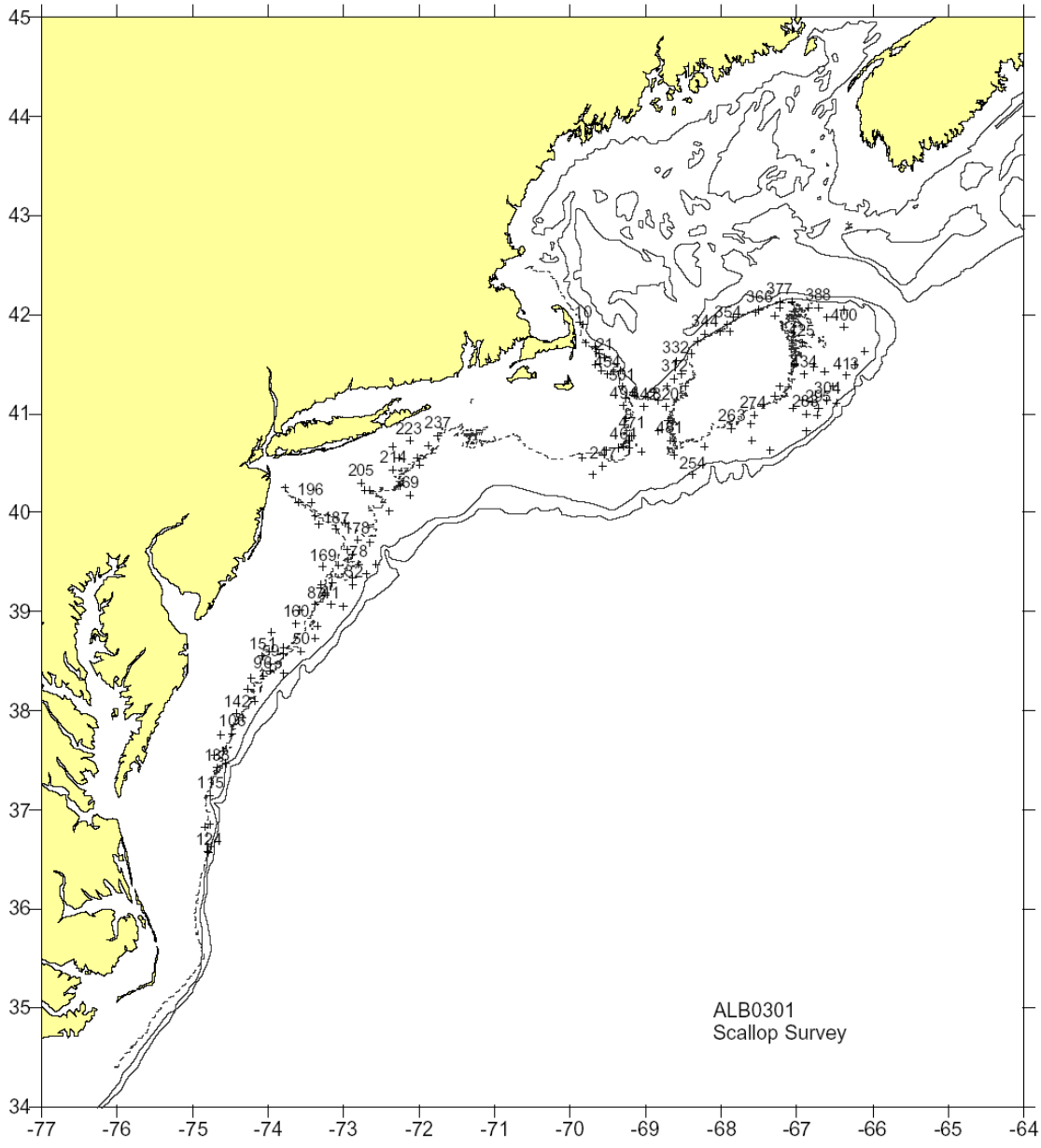


Figure 22. Hydrographic stations occupied during the Scallop Survey – ALB0301.

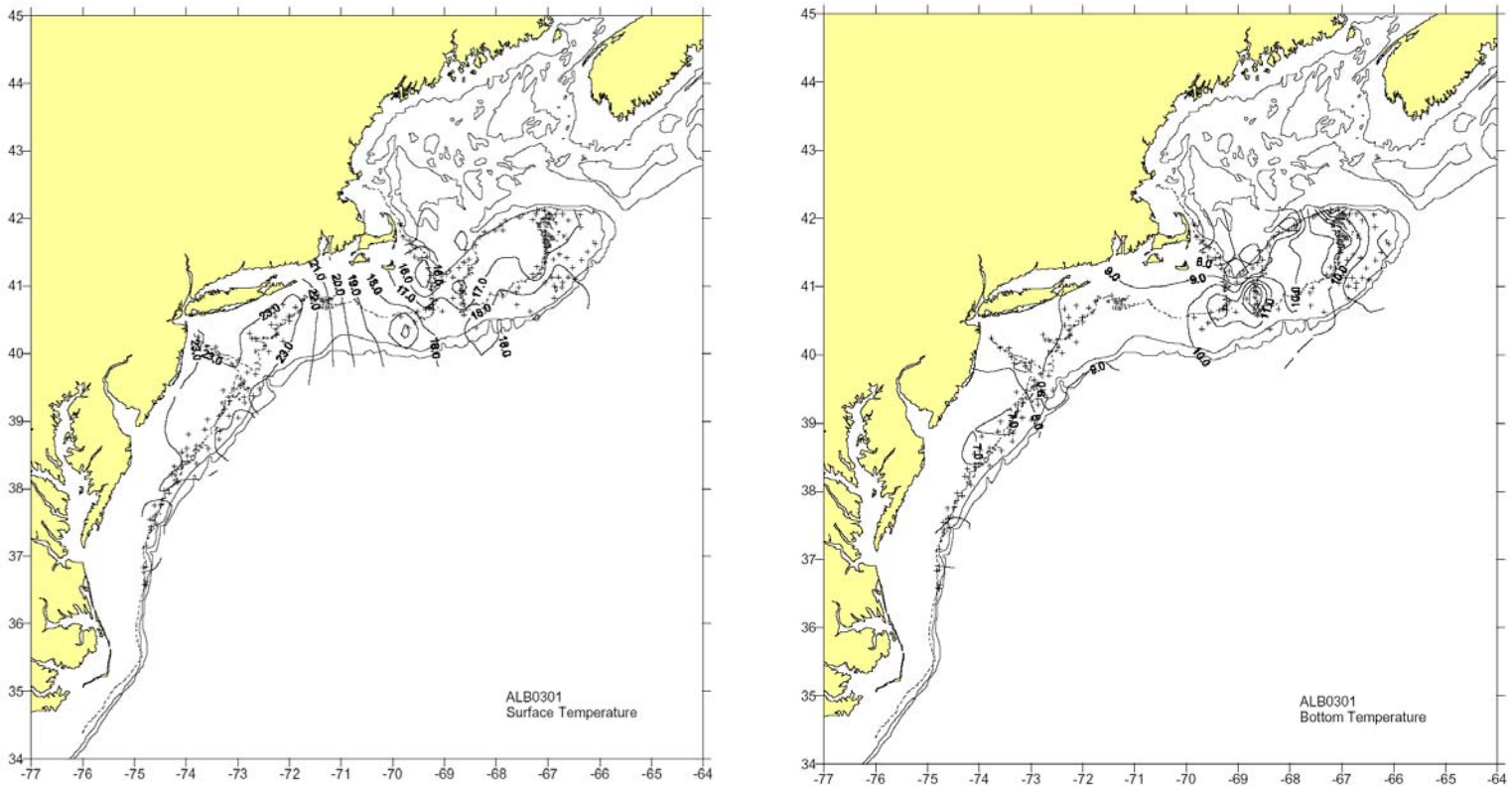


Figure 23. Surface and bottom temperature distributions for the Scallop survey ALB0301.

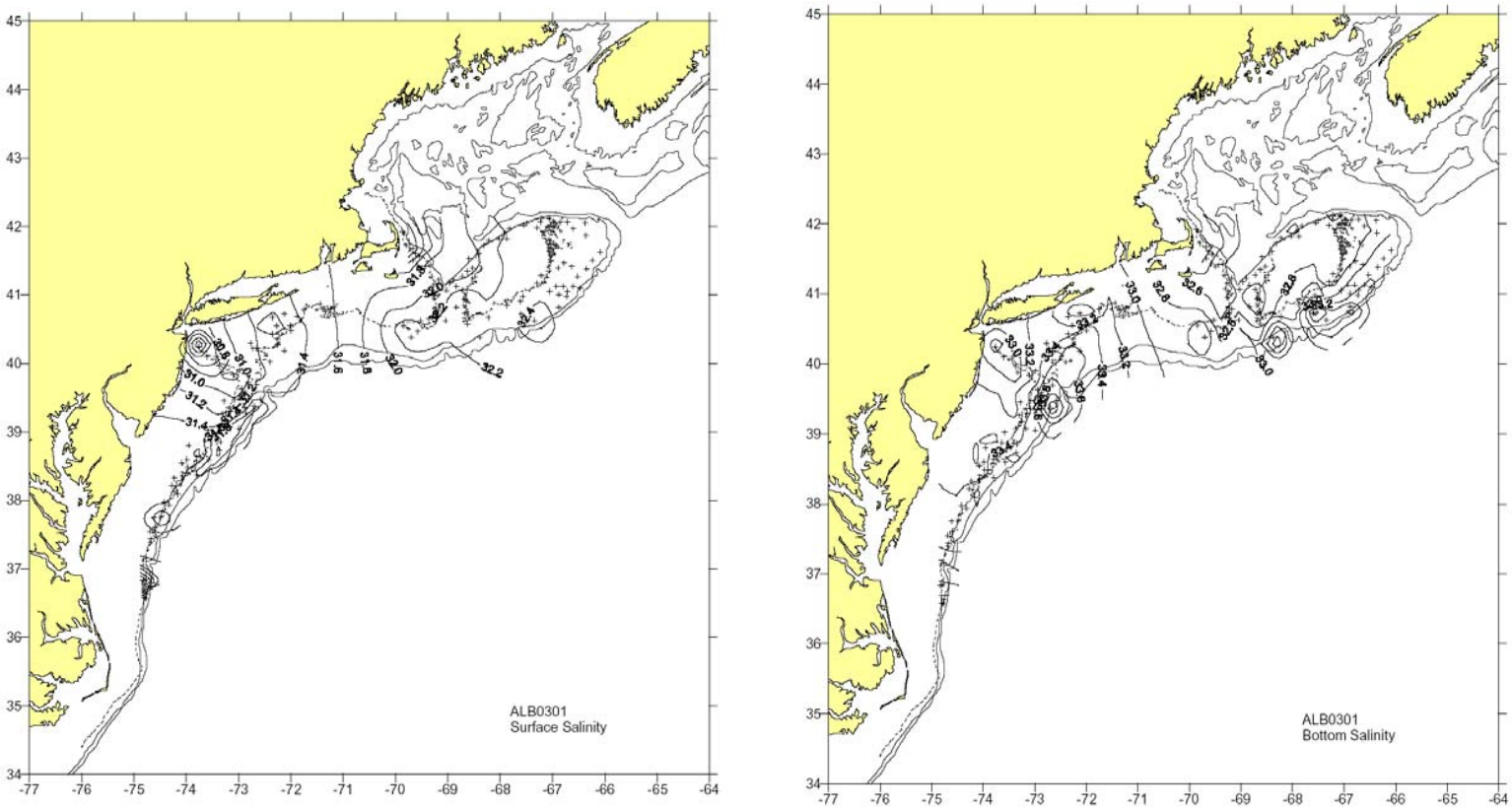


Figure 24. Surface and bottom salinity distributions for the Scallop survey ALB0301.

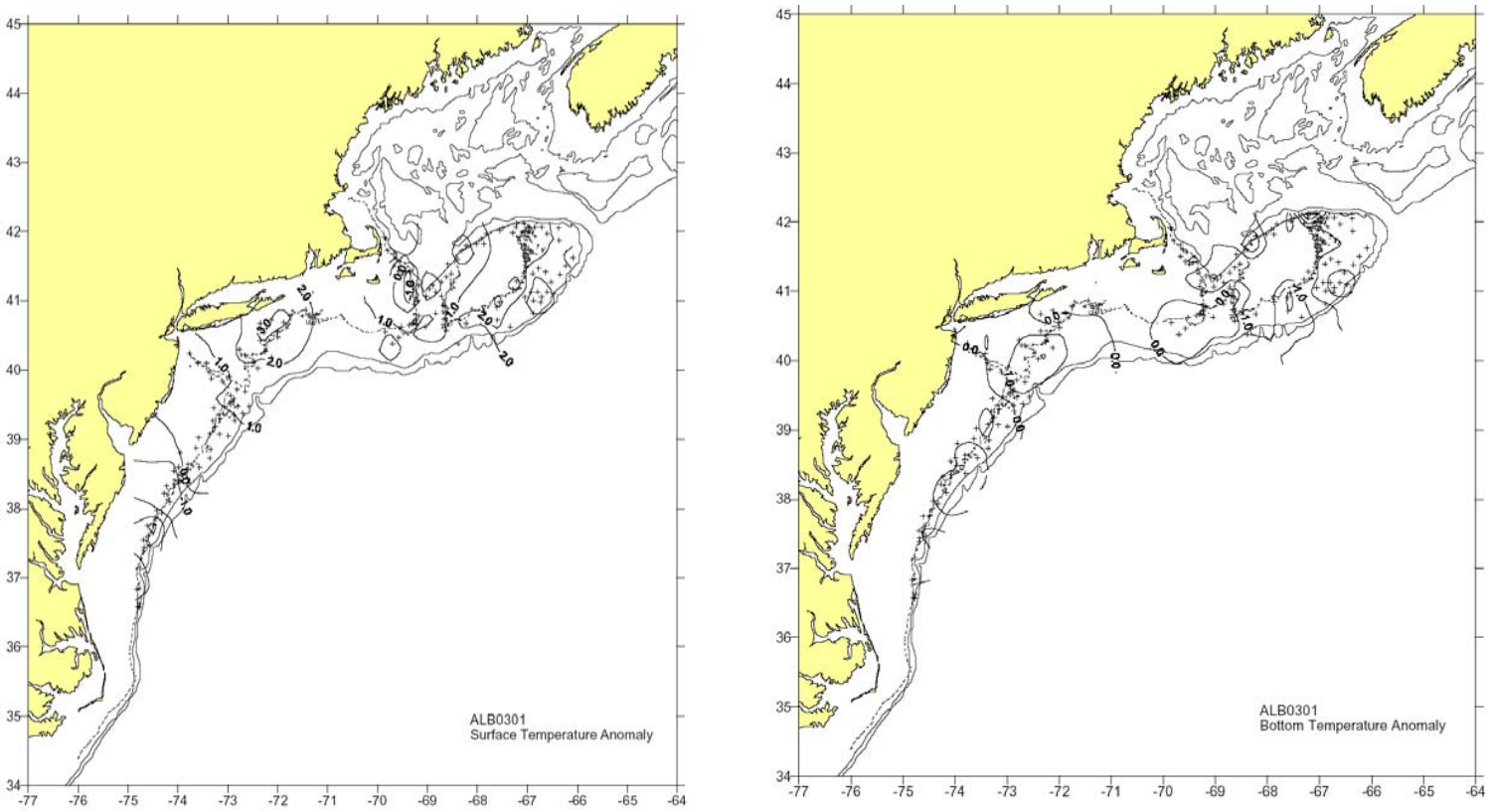


Figure 25. Surface and bottom temperature anomalies for the Scallop survey ALB0301.

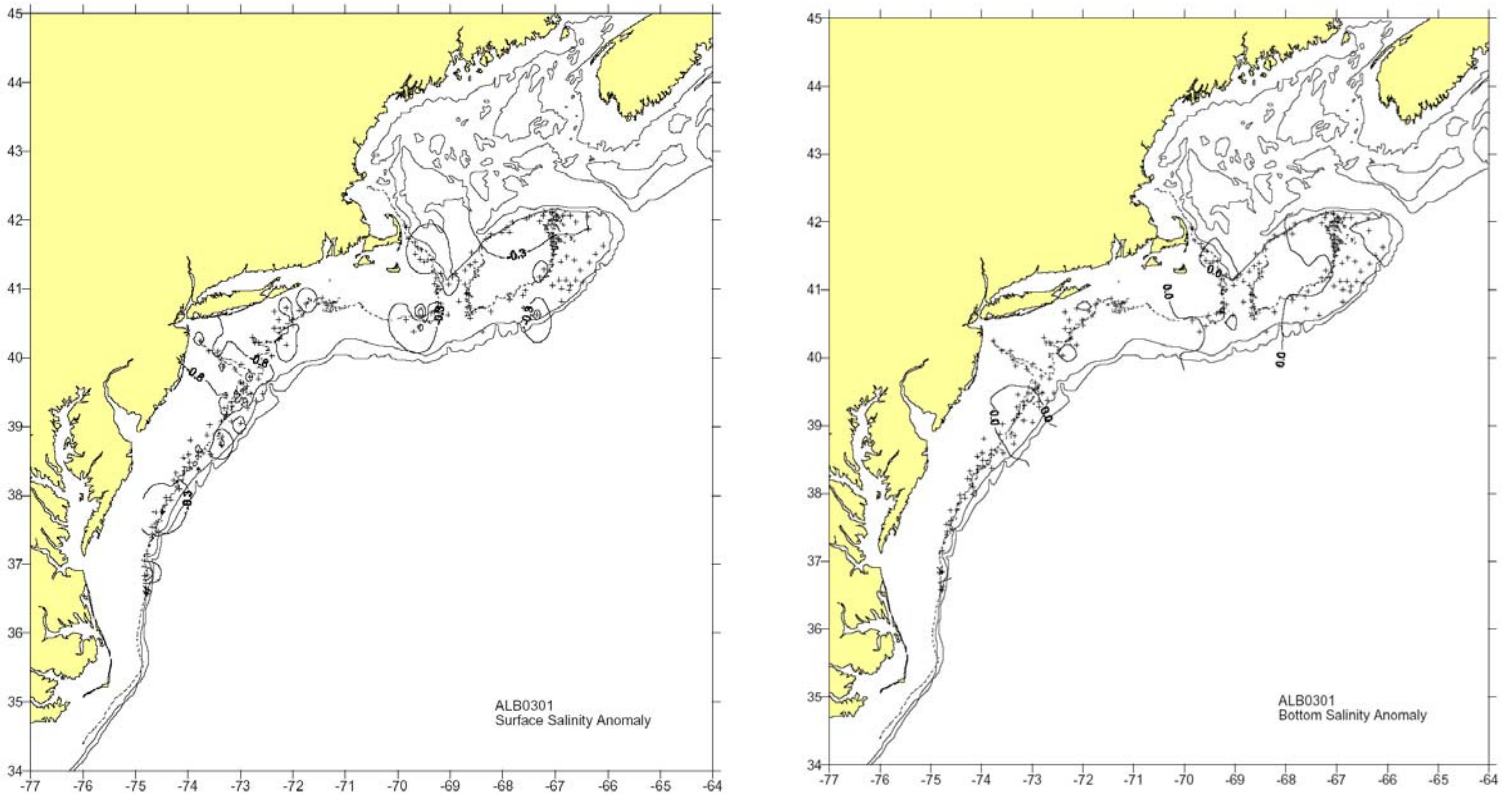


Figure 26. Surface and bottom salinity anomalies for the Scallop survey ALB0301.

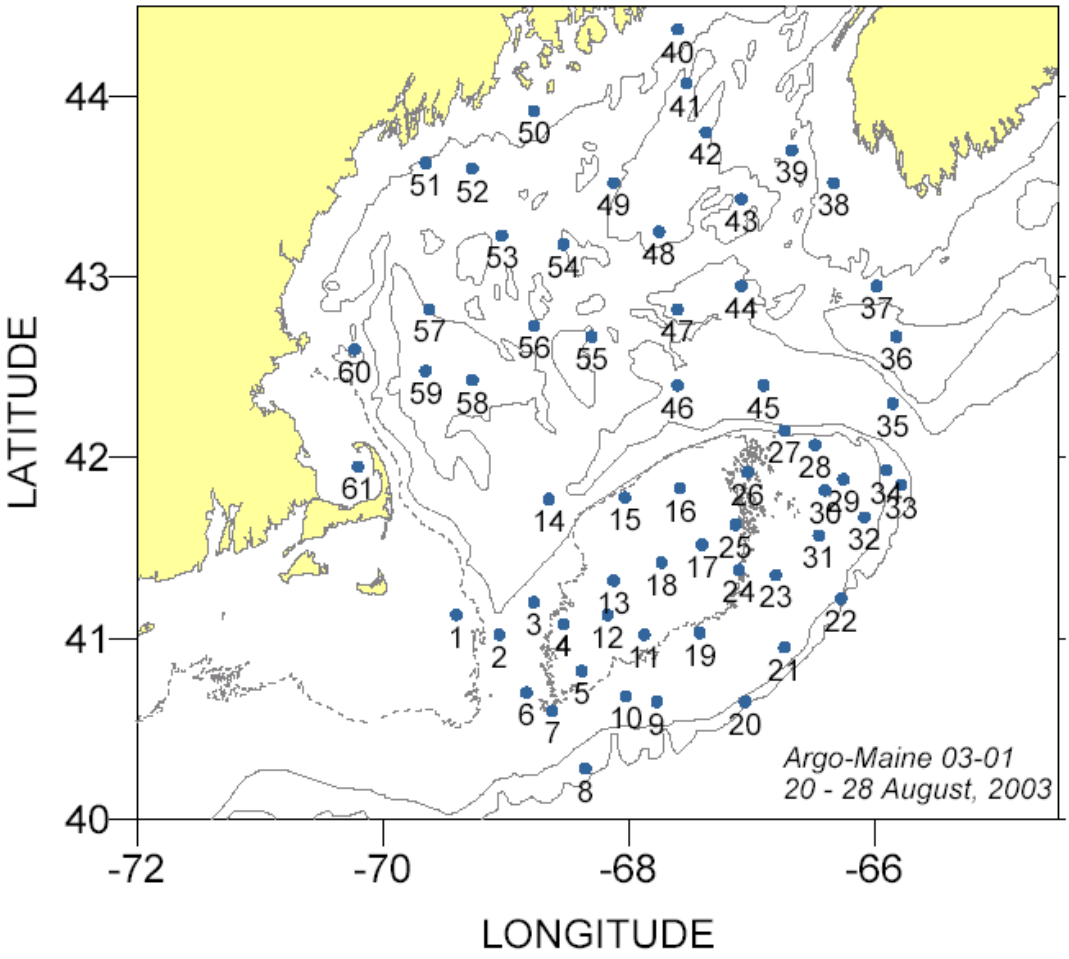


Figure 27. Hydrographic stations occupied during the ECOMON survey – ARM0301.

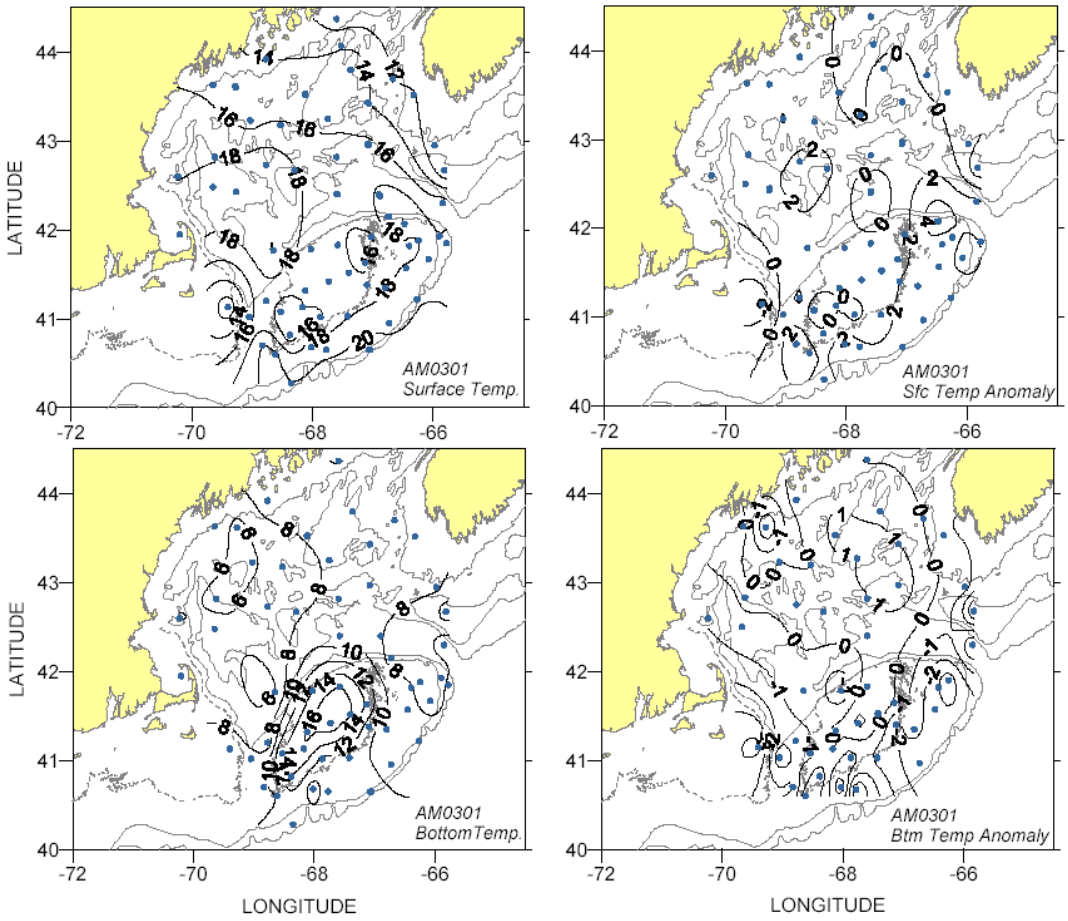


Figure 28. Surface and bottom temperature distributions and anomalies during the ECOMON survey – ARM0301.

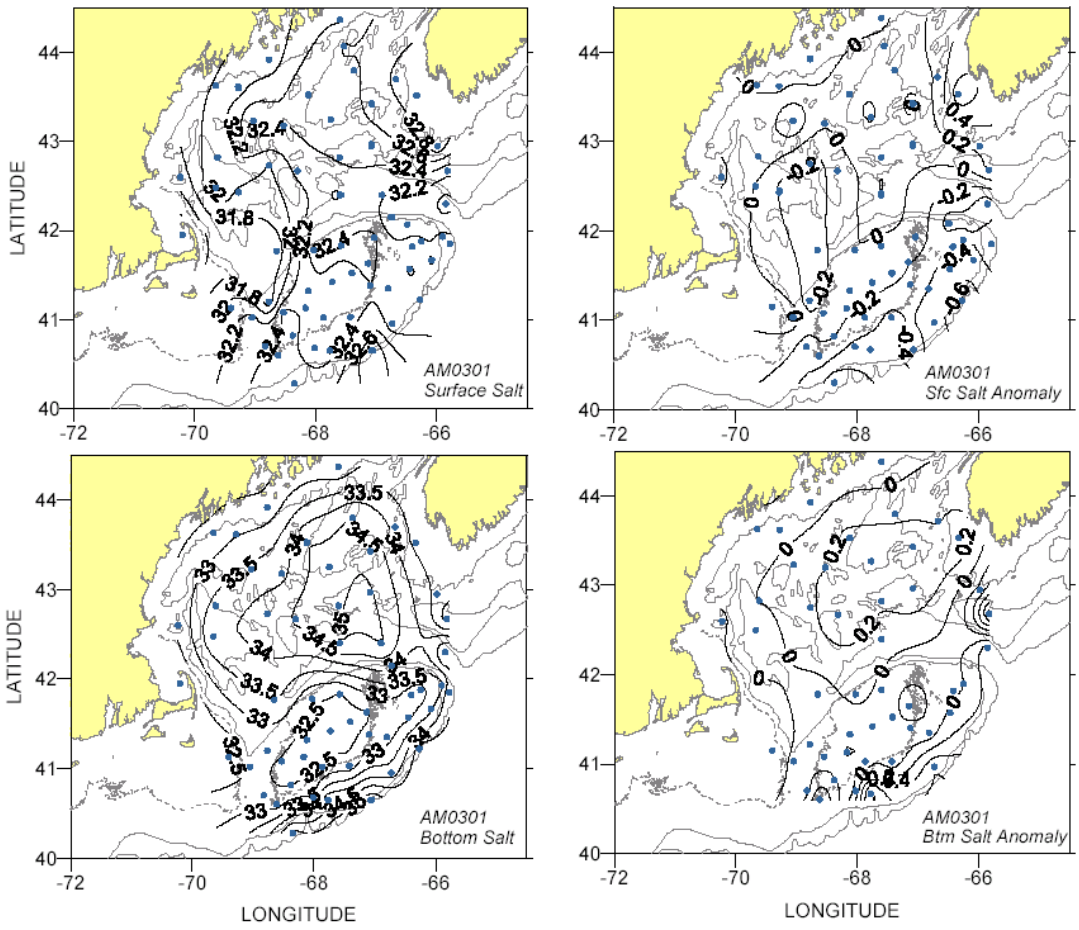


Figure 29. Surface and bottom salinity distributions and anomalies during the ECOMON survey – ARM0301.

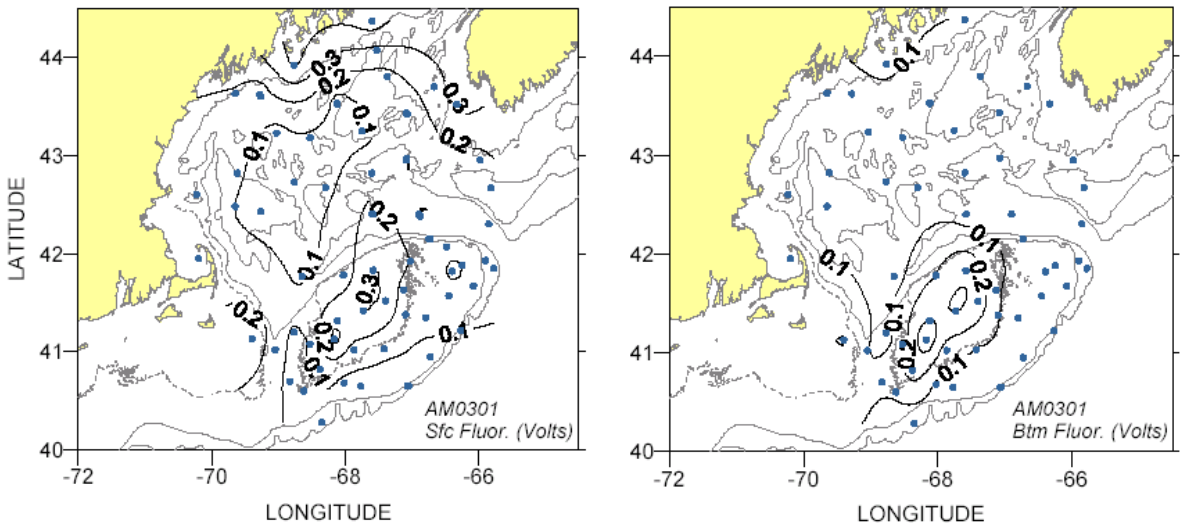


Figure 30. Surface and bottom fluorescence distributions during the ECOMON survey – ARM0301.

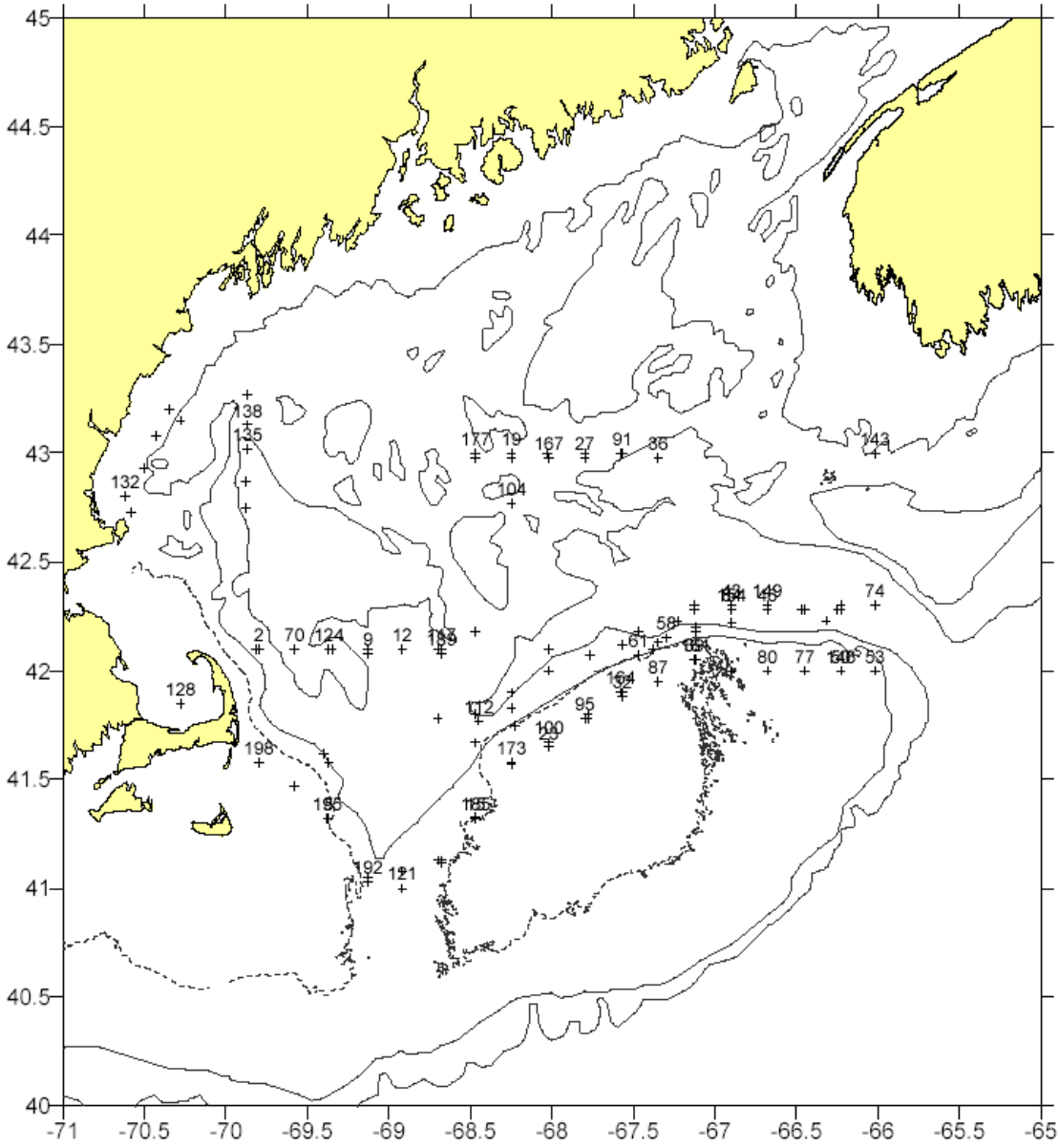


Figure 31. Hydrographic stations occupied during the Hydro Acoustic survey DEL0308.

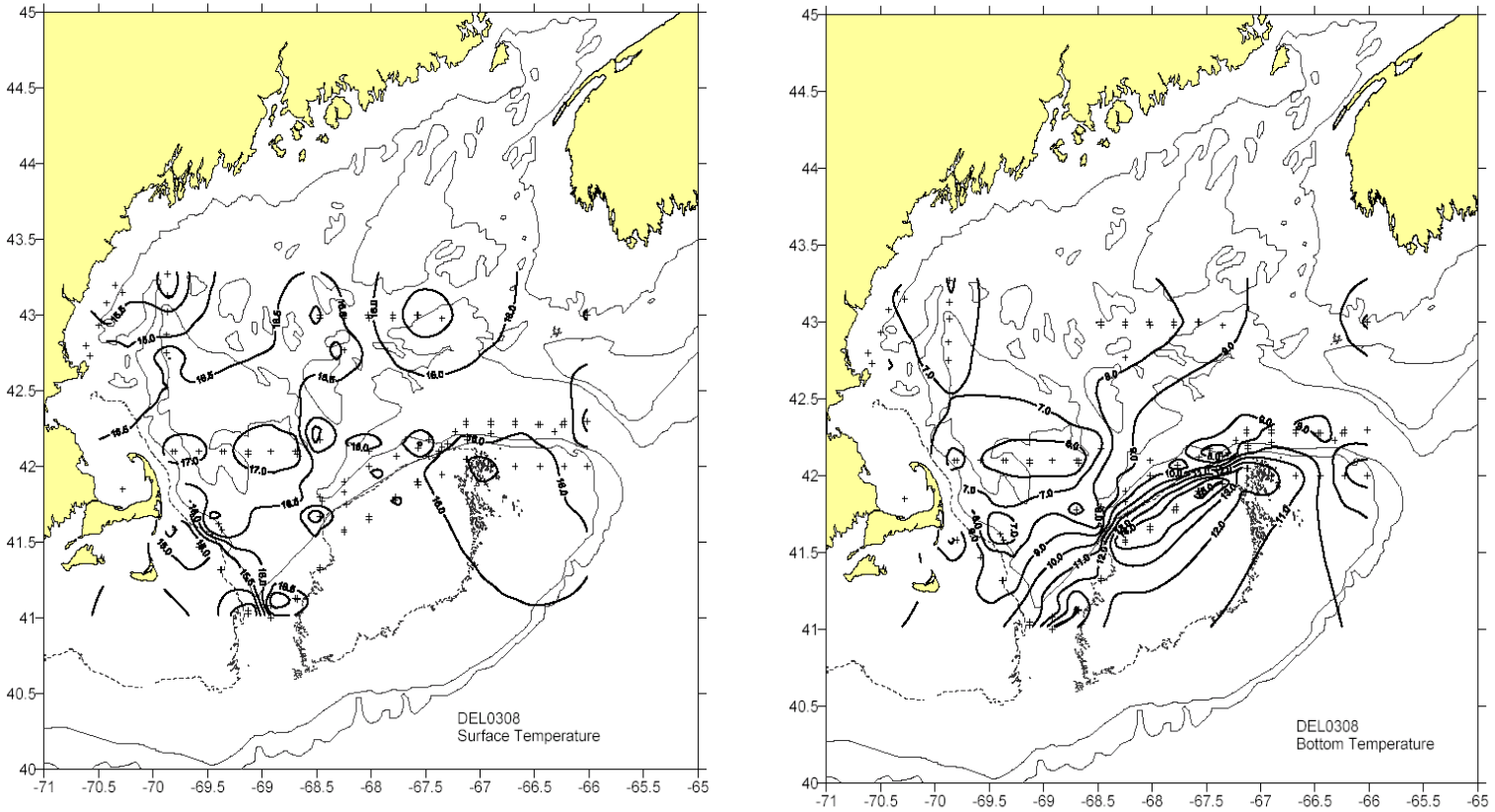


Figure 32. Surface and bottom temperature distributions for the Hydro Acoustic survey DEL0308.

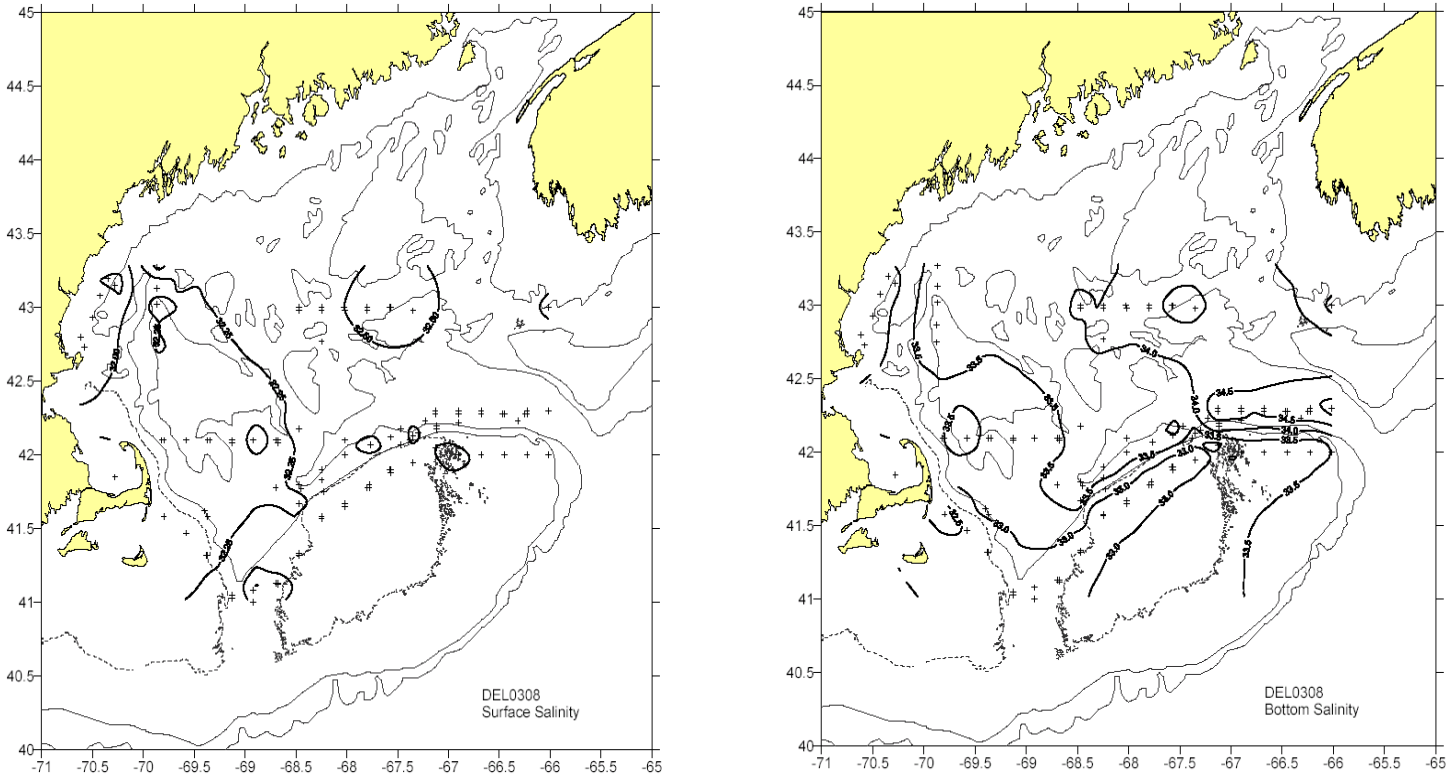


Figure 33. Surface and bottom salinity distributions for the Hydro Acoustic survey DEL0308.

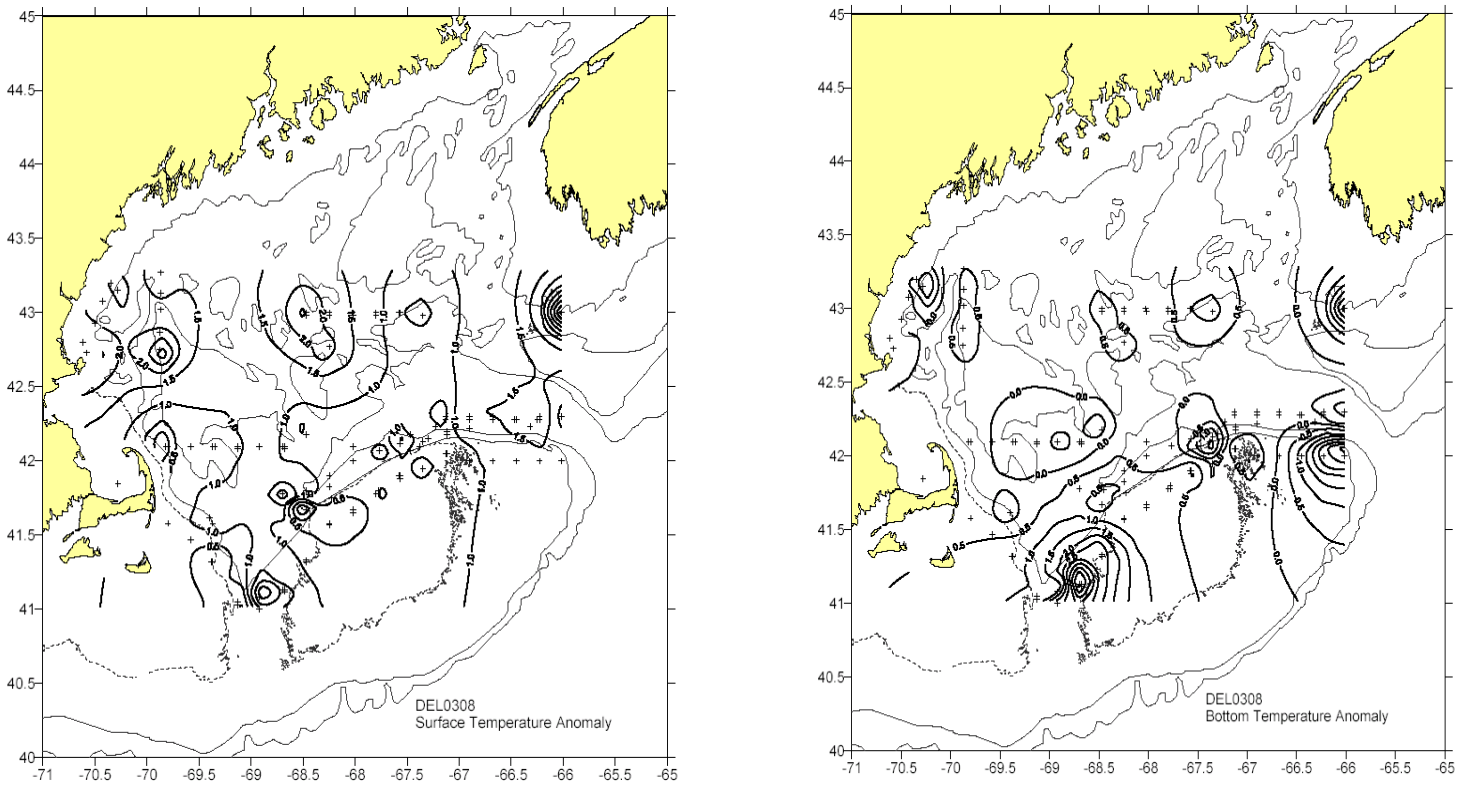


Figure 34. Surface and bottom temperature anomalies for the Hydro Acoustic survey DEL0308.

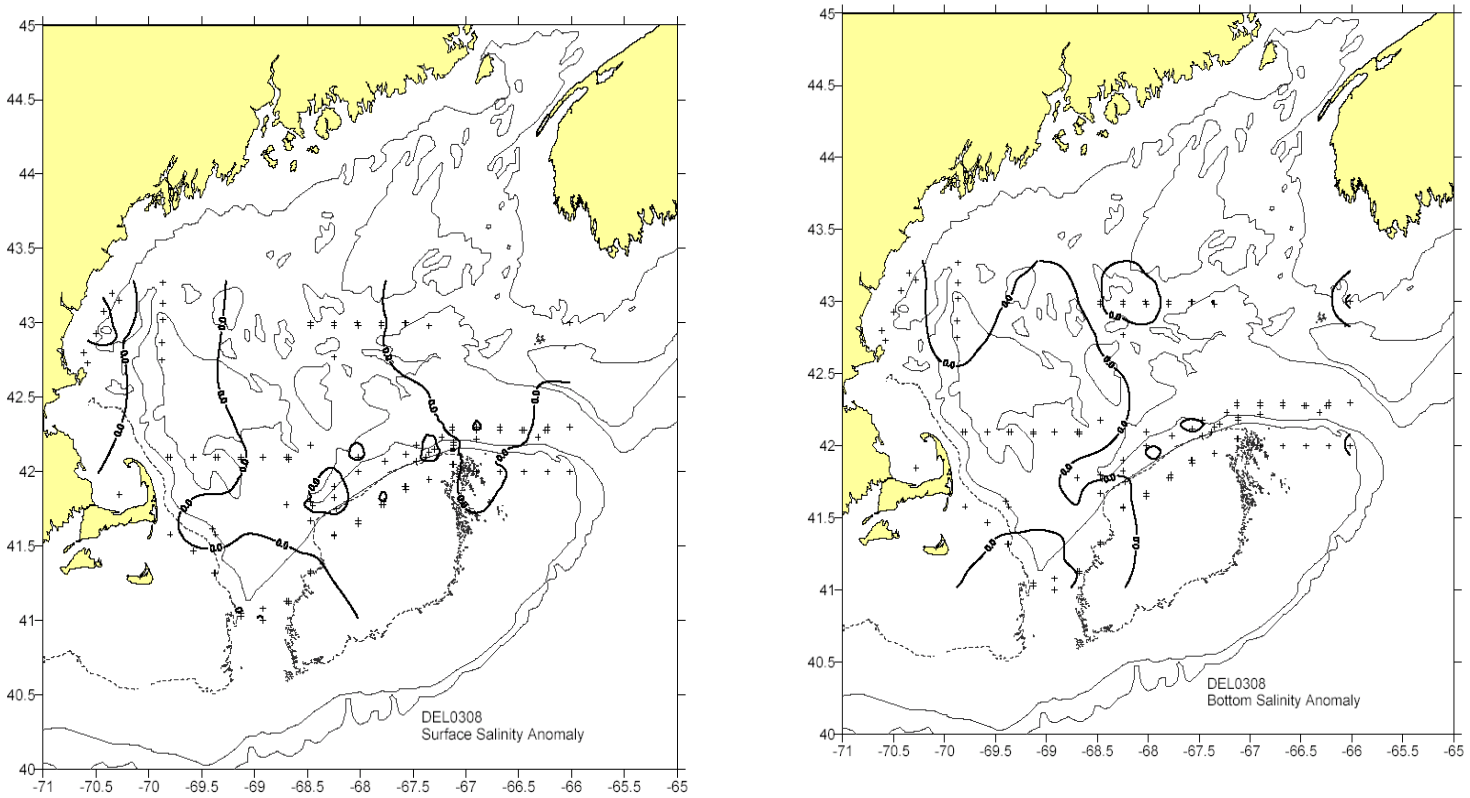


Figure 35. Surface and bottom salinity anomalies for the Hydro Acoustic survey DEL0308.

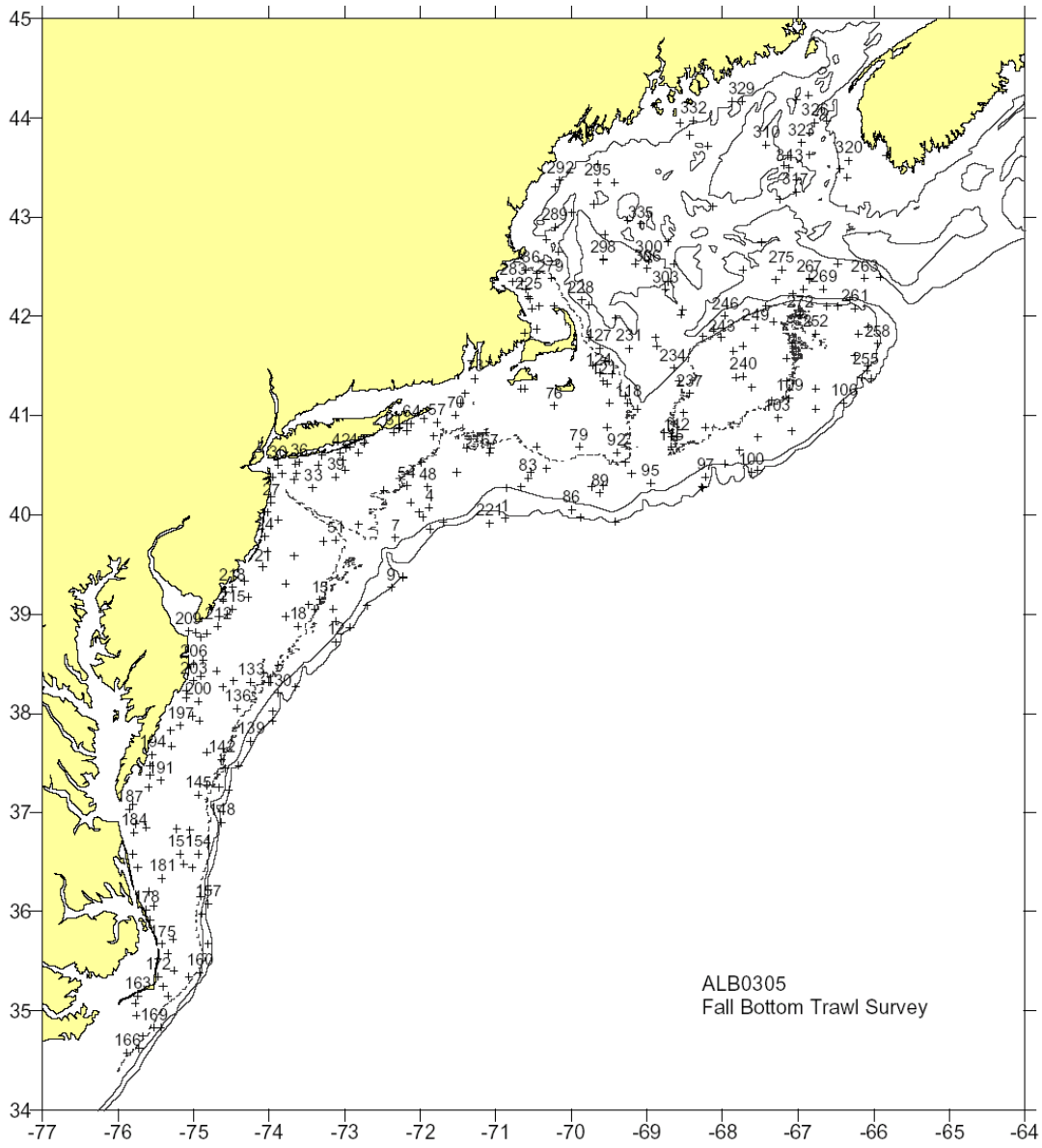


Figure 36. Hydrographic stations occupied during the Fall Bottom Trawl survey ALB0305.

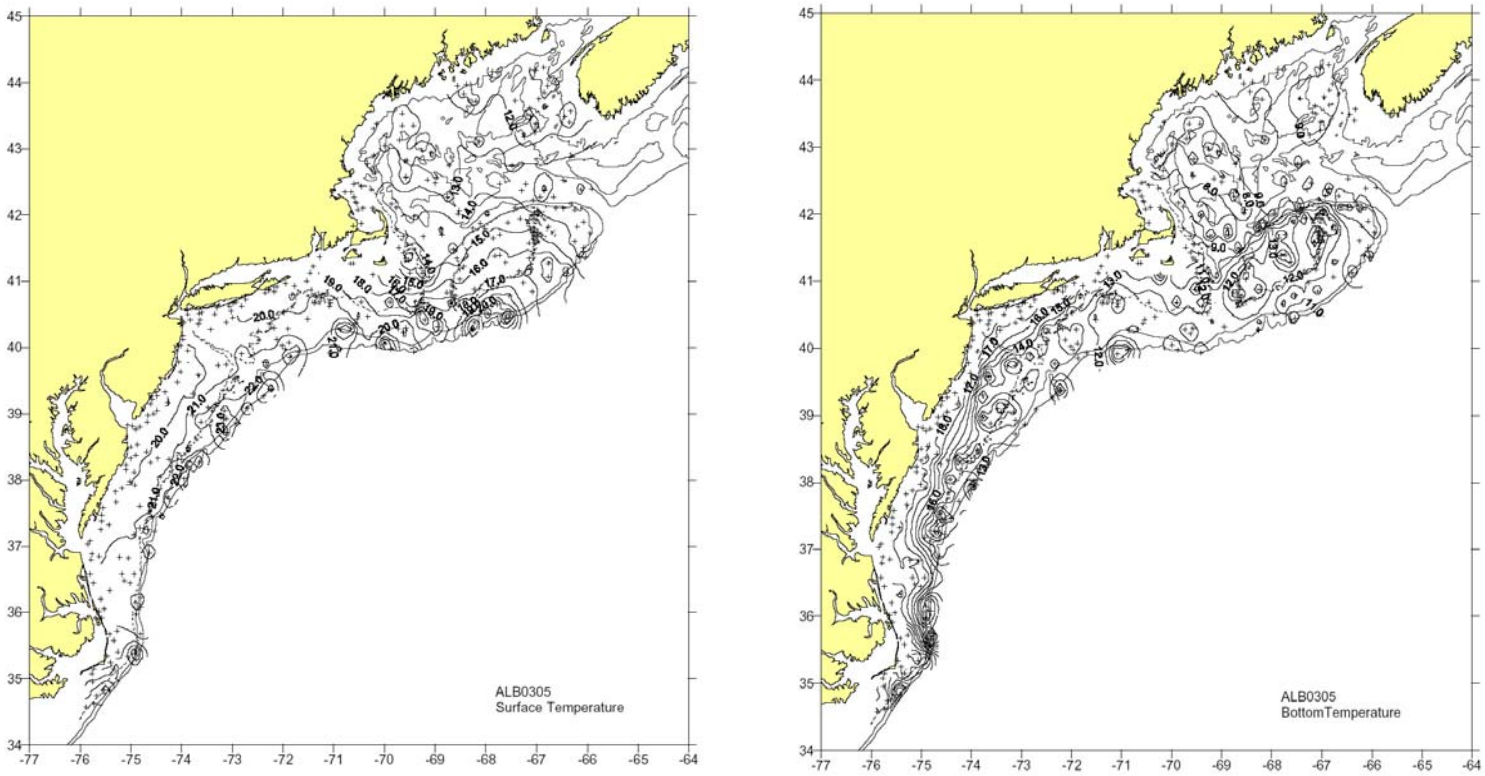


Figure 37. Surface and bottom temperature distributions for the Fall Bottom Trawl survey ALB0305.

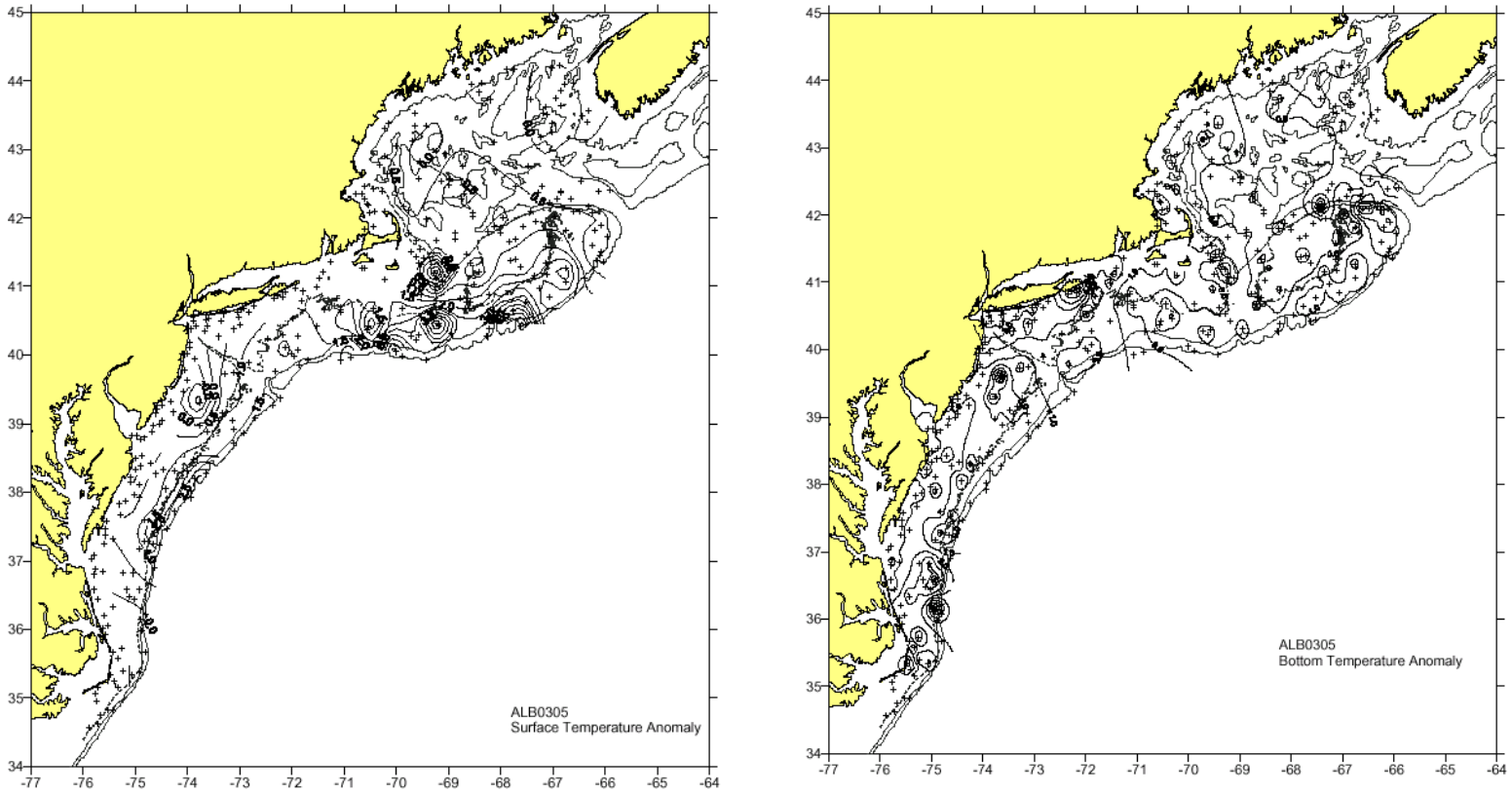


Figure 38. Surface and bottom temperature anomalies for the Fall Bottom Trawl survey ALB0305.

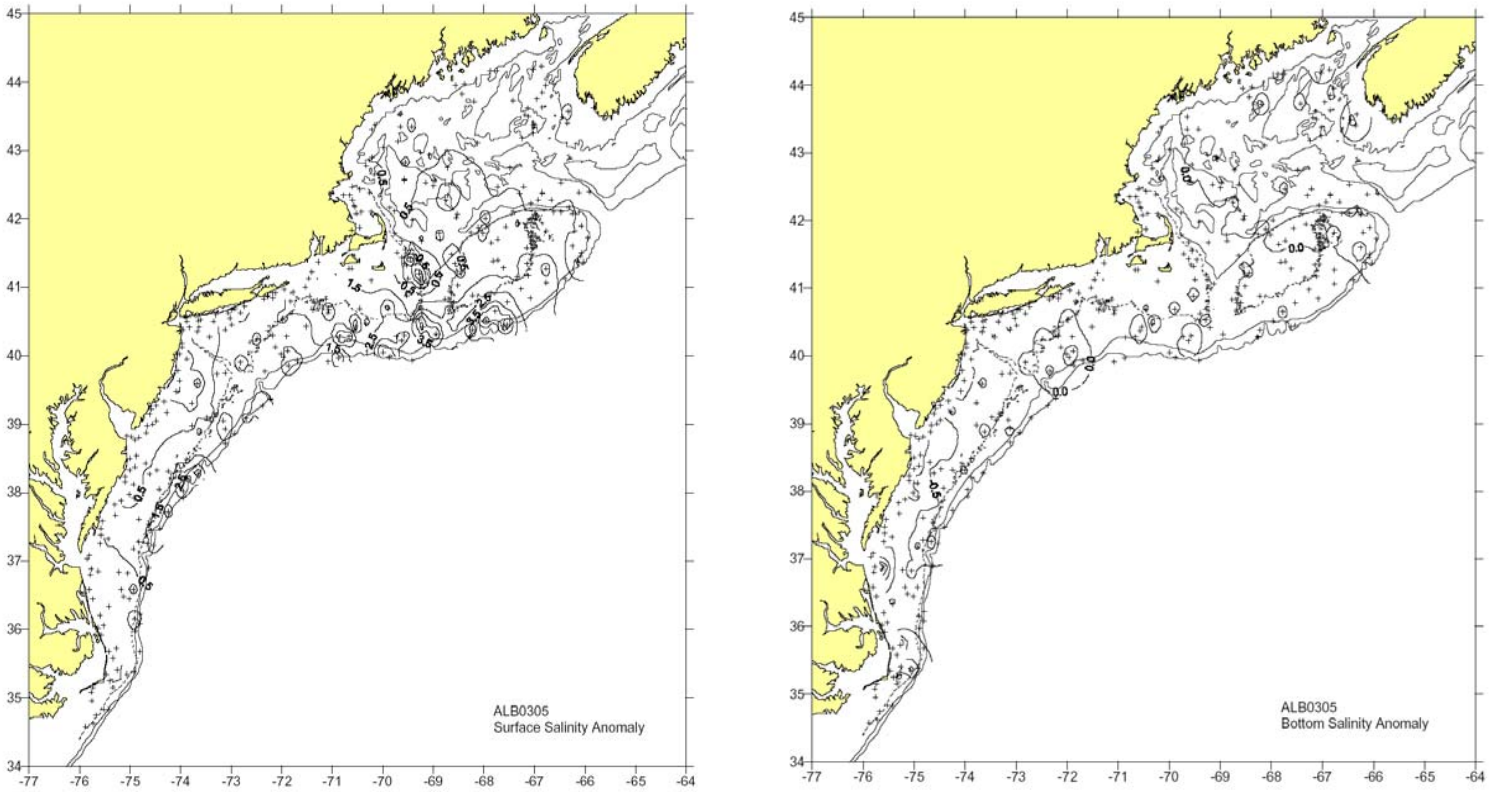


Figure 39. Surface and bottom salinity anomalies for the Fall Bottom Trawl survey ALB0305.

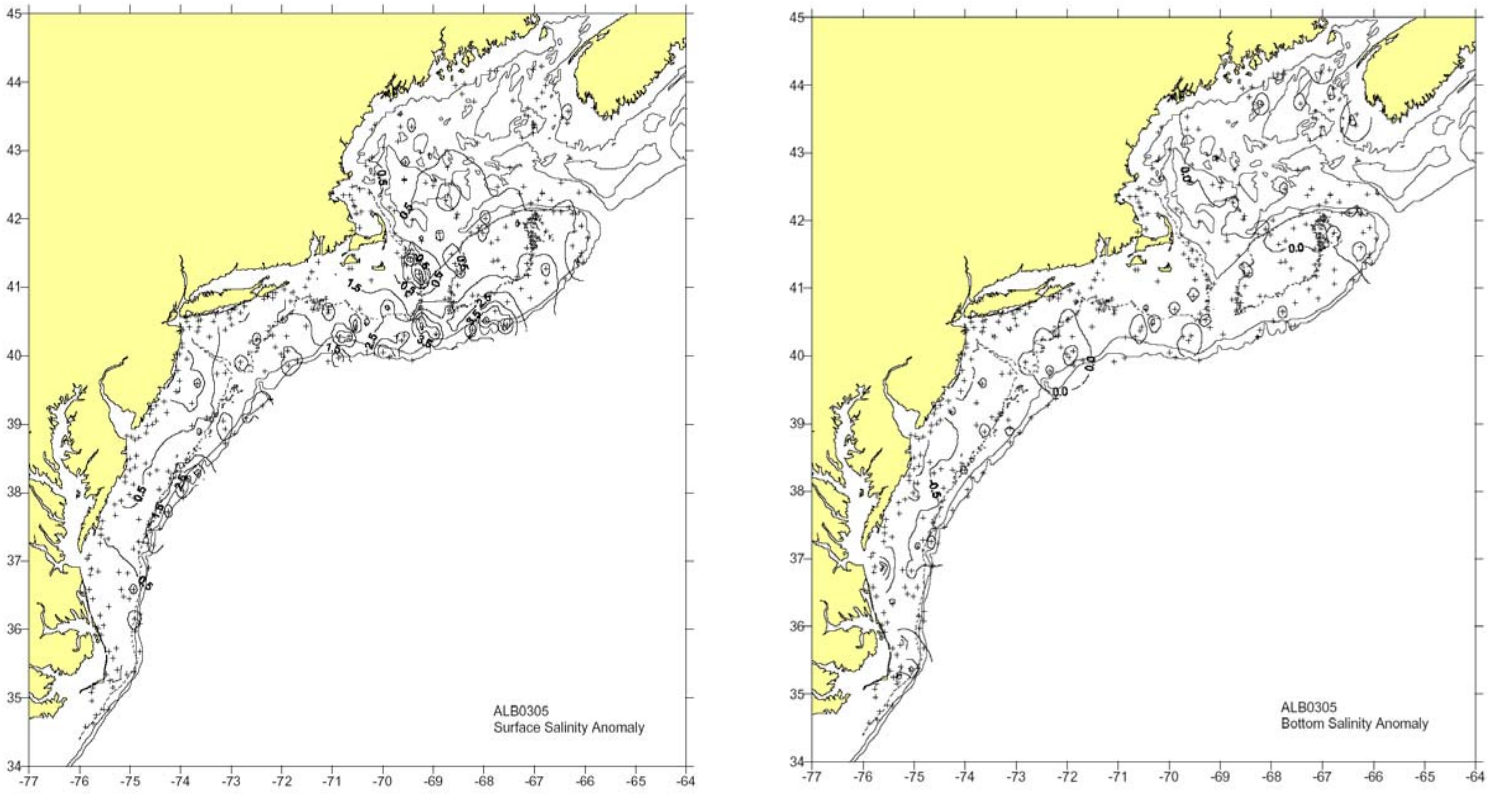


Figure 40. Surface and bottom salinity anomalies for the Fall Bottom Trawl survey ALB0305.

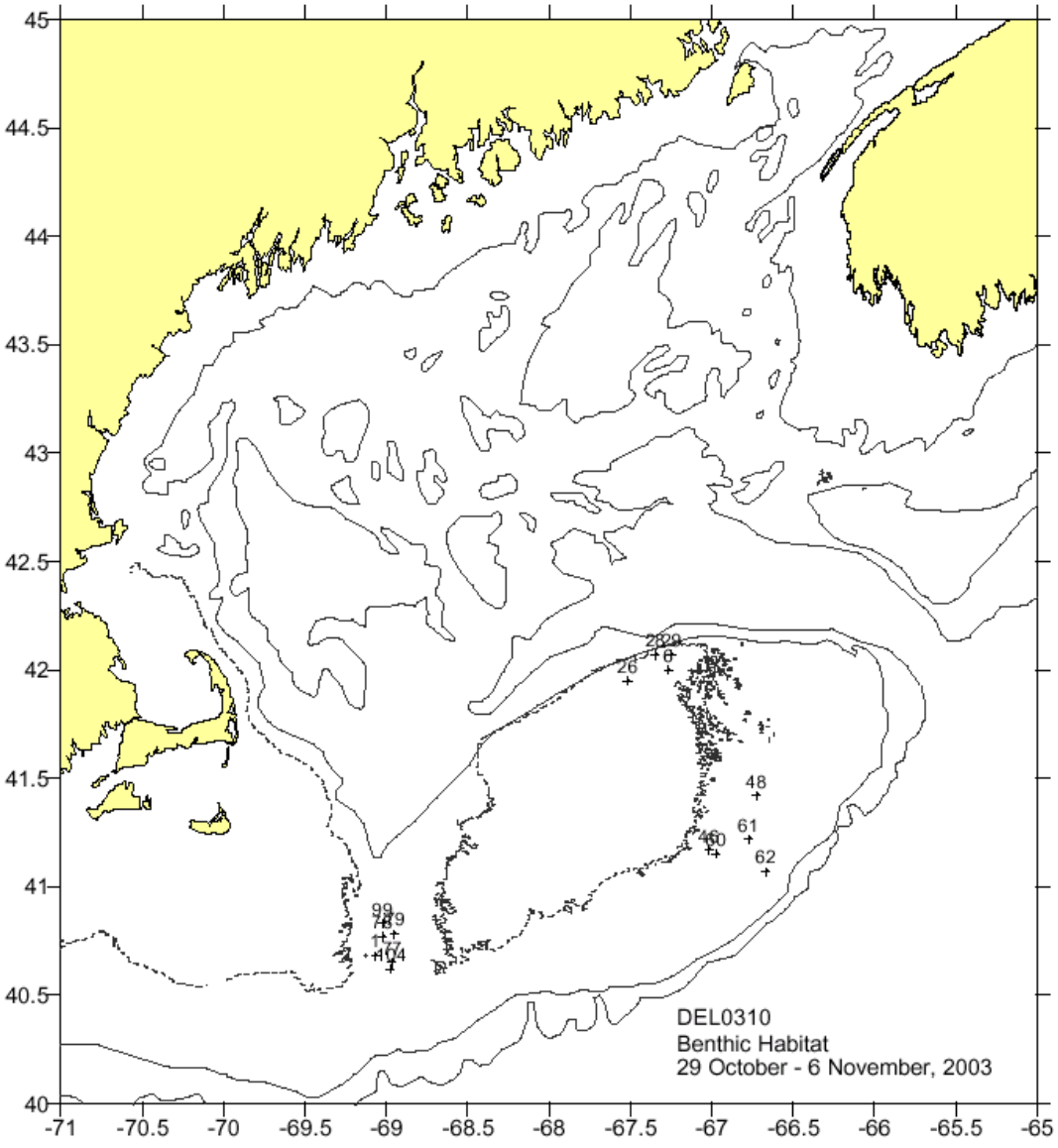


Figure 41. Hydrographic stations occupied during the Benthic Habitat cruise DEL0310.

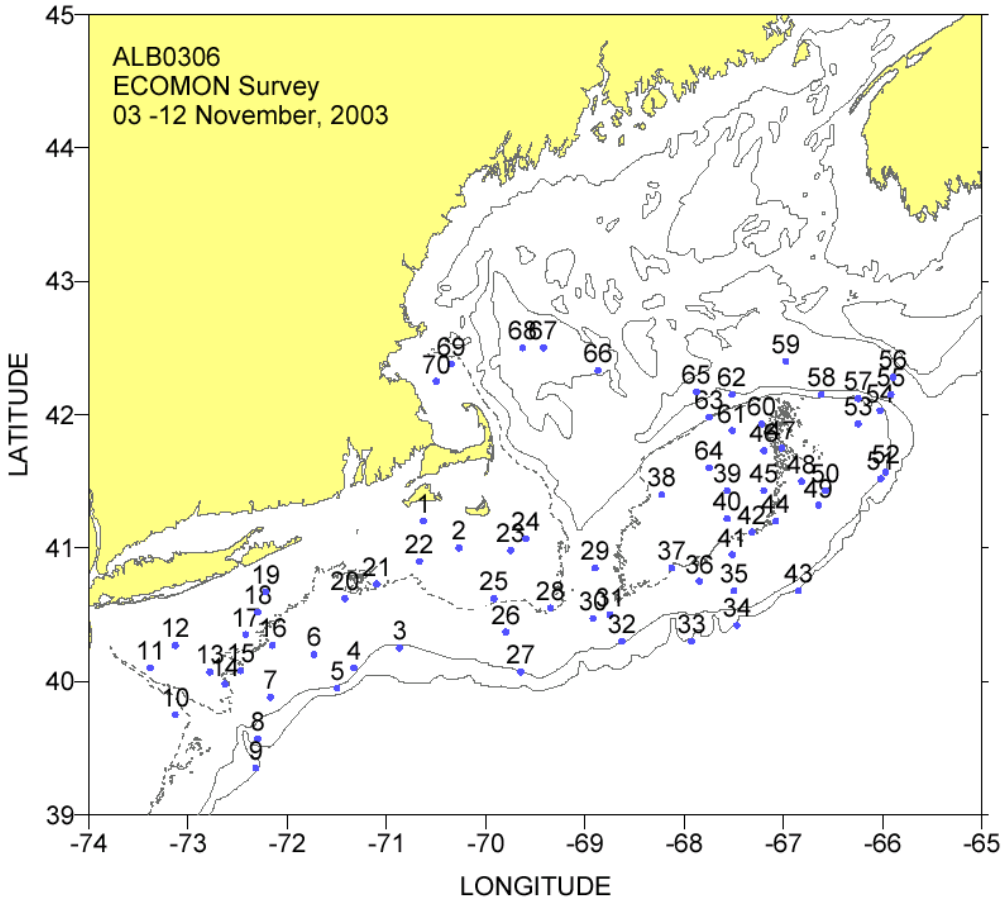


Figure 42. Hydrographic stations occupied during the ECOMON survey ALB0306.

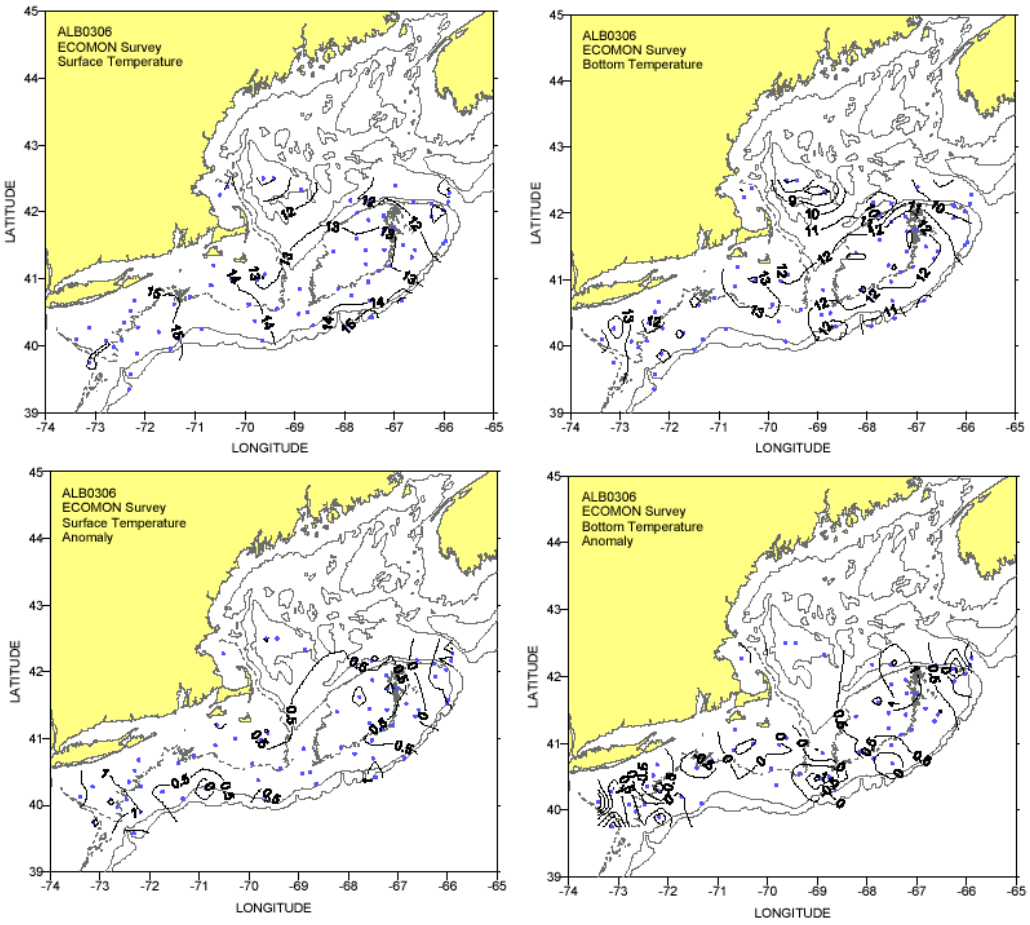


Figure 43. Surface and bottom temperature distributions and anomalies during the ECOMON survey ALB0306.

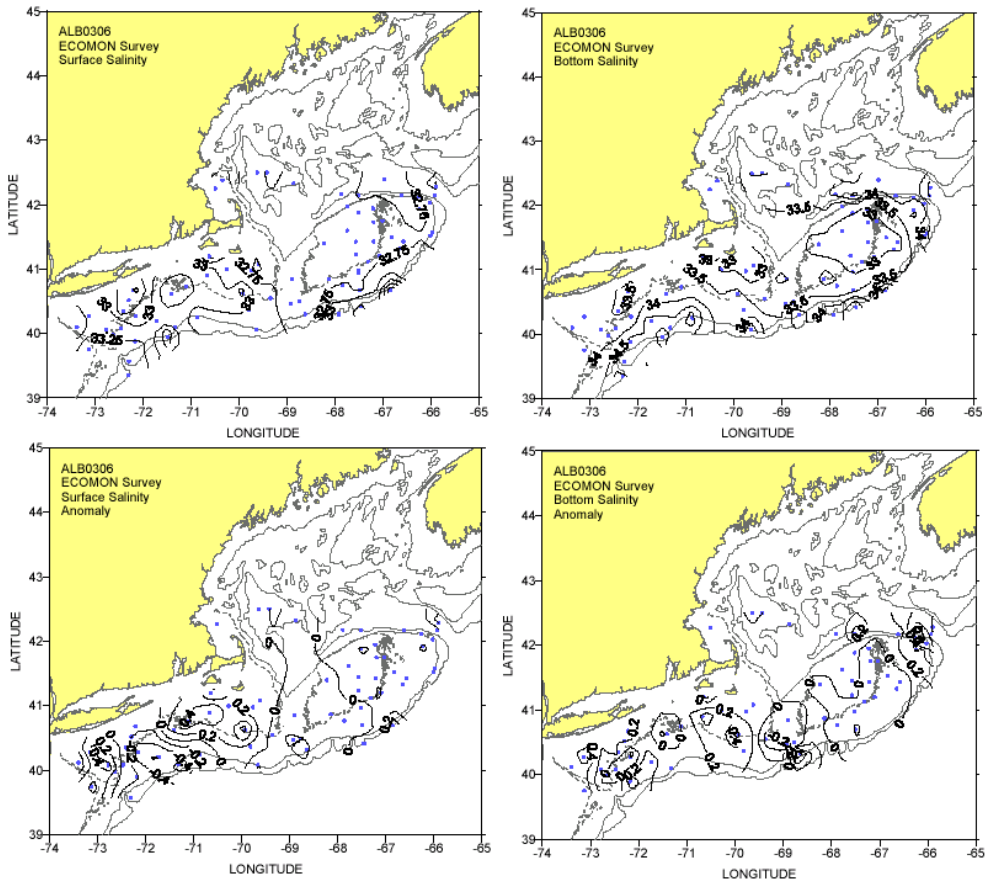


Figure 44. Surface and bottom salinity distributions and anomalies during the ECOMON survey ALB0306.

Appendix A. Summary of 2003 cruise operations.

Ecosystems Monitoring Survey

Cruise:	DEL0301
Vessel:	R/V Delaware II
Dates:	23 – 31 January
Sea Days:	9
Instrument(s):	1495, 2277
Total # of stations:	67
# of vertical CTD/Profiler casts:	0
# of double oblique Profiler casts:	59
# Salinity samples:	7
Salt correction:	N\A

Cruise Objectives: To assess the impact of changing biological and physical properties of the Northeast Continental Shelf ecosystem which influence the sustainable productivity of the living marine resources.

Winter Bottom Trawl Survey

Cruise:	DEL0302
Vessel:	R/V Delaware II
Dates:	6 February – 1 March
Sea Days:	17
Instrument(s):	2277, 1447
Total # of stations:	103
# of vertical CTD/Profiler casts:	34
# of double oblique Profiler casts:	39
# Salinity samples:	27
Salt correction:	-0.002

Cruise Objectives: To (1) determine the winter distribution and relative abundance of fish and invertebrate species; (2) collect biological samples for studies of age and growth relationships, fecundity, maturity, and food habits; (3) collect hydrographic and meteorological data; (4) make collections of data and samples for cooperative researchers and programs.

Spring Bottom Trawl Survey

Cruise:	DEL0303
Vessel:	R/V Delaware II
Dates:	3 March – 27 April
Sea Days:	43
Instrument(s):	1447, 1496, 0851, 2277
Total # of stations:	341
# of vertical CTD/Profiler casts:	168
# of double oblique Profiler casts:	123
# Salinity samples:	50
Salt correction:	2277=+**0.000**; 0851=+**0.001**; 1496=+**0.010**

Cruise Objectives: To (1) determine the spring distribution and relative abundance of fish and invertebrate species; (2) collect biological samples for studies of age and growth relationships, fecundity, maturity, and food habits; (3) collect hydrographic and meteorological data; (4) make collections of data and samples for cooperative researchers and programs.

Ecosystems Monitoring Survey

Cruise:	DEL0305
Vessel:	R/V Delaware II
Dates:	24 – 29 May
Sea Days:	6
Instrument(s):	2879
Total # of stations:	44
# of vertical CTD/Profiler casts:	1
# of double oblique Profiler casts:	36
# Salinity samples:	21
Salt correction:	-0.006

Cruise Objectives: To assess the impact of changing biological and physical properties of the Northeast Continental Shelf ecosystem which influence the sustainable productivity of the living marine resources.

Cetacean Tagging

Cruise:	DEL0306
Vessel:	R/V Delaware II
Dates:	16 – 31 July
Sea Days:	10
Instrument(s):	2277
Total # of stations:	11
# of vertical CTD/Profiler casts:	2
# of double oblique Profiler casts:	0
# Salinity samples:	9
Salt correction:	-0.001

Cruise Objectives: (1) to deploy satellite-monitored radio tags on North Atlantic right whales, (2) to deploy VHF-linked time-depth recorders (TDRs) on right whales to examine diving behavior relative to prey abundance and availability and (3) to conduct systematic, broad-scale oceanographic and marine mammal surveys to characterize right whale habitat.

Scallop Survey

Cruise:	ALB0301
Vessel:	R/V Albatross IV
Dates:	2 July – 5 September
Sea Days:	27
Instrument(s):	1496
Total # of stations:	504
# of vertical CTD/Profiler casts:	113
# of double oblique Profiler casts:	N/A
# Salinity samples:	45
Salt correction:	+0.007

Cruise Objectives: To (1) determine the distribution and relative abundance of the sea scallop *Placopecten magellanicus* and Iceland scallop *Chlamys islandica*; (2) collect

biological samples and data relative to assessment needs; (3) monitor hydrographic and meteorological conditions; and (4) make collections for interested scientists at other institutions and laboratories.

Ecosystem Monitoring

Cruise:	ARM0301
Vessel:	R/V Argo Maine
Dates:	20 – 28 August
Sea Days:	9
Instrument(s):	2879
Total # of stations:	61
# of vertical CTD/Profiler casts:	5
# of double oblique Profiler casts:	65
# Salinity samples:	16
Salt correction:	+0.002

Cruise Objectives: To assess the impact of changing biological and physical properties of the Northeast Continental Shelf ecosystem which influence the sustainable productivity of the living marine resources.

HydroAcoustic Survey

Cruise:	DEL0308
Vessel:	R/V Delaware II
Dates:	4 September – 10 October
Sea Days:	26
Instrument(s):	2277
Total # of stations:	198
# of vertical CTD/Profiler casts:	135
# of double oblique Profiler casts:	N/A
# Salinity samples:	12
Salt correction:	+0.022

Cruise Objectives: The primary goal is to provide fisheries independent abundance estimates of Atlantic herring in the Georges Bank and Gulf of Maine regions, and to calibrate the EK-500 echo-integrator and test the mid-water trawl performance.

Fall Groundfish Survey

Cruise:	ALB0305
Vessel:	R/V Albatross IV
Dates:	7 September – 31 October
Sea Days:	41
Instrument(s):	1496, 1495
Total # of stations:	336
# of vertical CTD/Profiler casts:	75
# of double oblique Profiler casts:	113
# Salinity samples:	48
Salt correction:	1496=**+0.006**; 1495=**+0.002**

Cruise Objectives: To (1) determine the autumn distribution and relative abundance of fish and invertebrate species; (2) collect biological samples for studies of age and growth relationships, fecundity, maturity, an food habits; (3) collect hydrographic and meteorological data; (4) make collections of data and samples for cooperative researchers and programs.

Benthic Habitat

Cruise:	DEL0310
Vessel:	R/V Delaware II
Dates:	29 October – 6 November
Sea Days:	8
Instrument(s):	2277
Total # of stations:	104
# of vertical CTD/Profiler casts:	8
# of double oblique Profiler casts:	N/A
# Salinity samples:	7
Salt correction:	+0.000

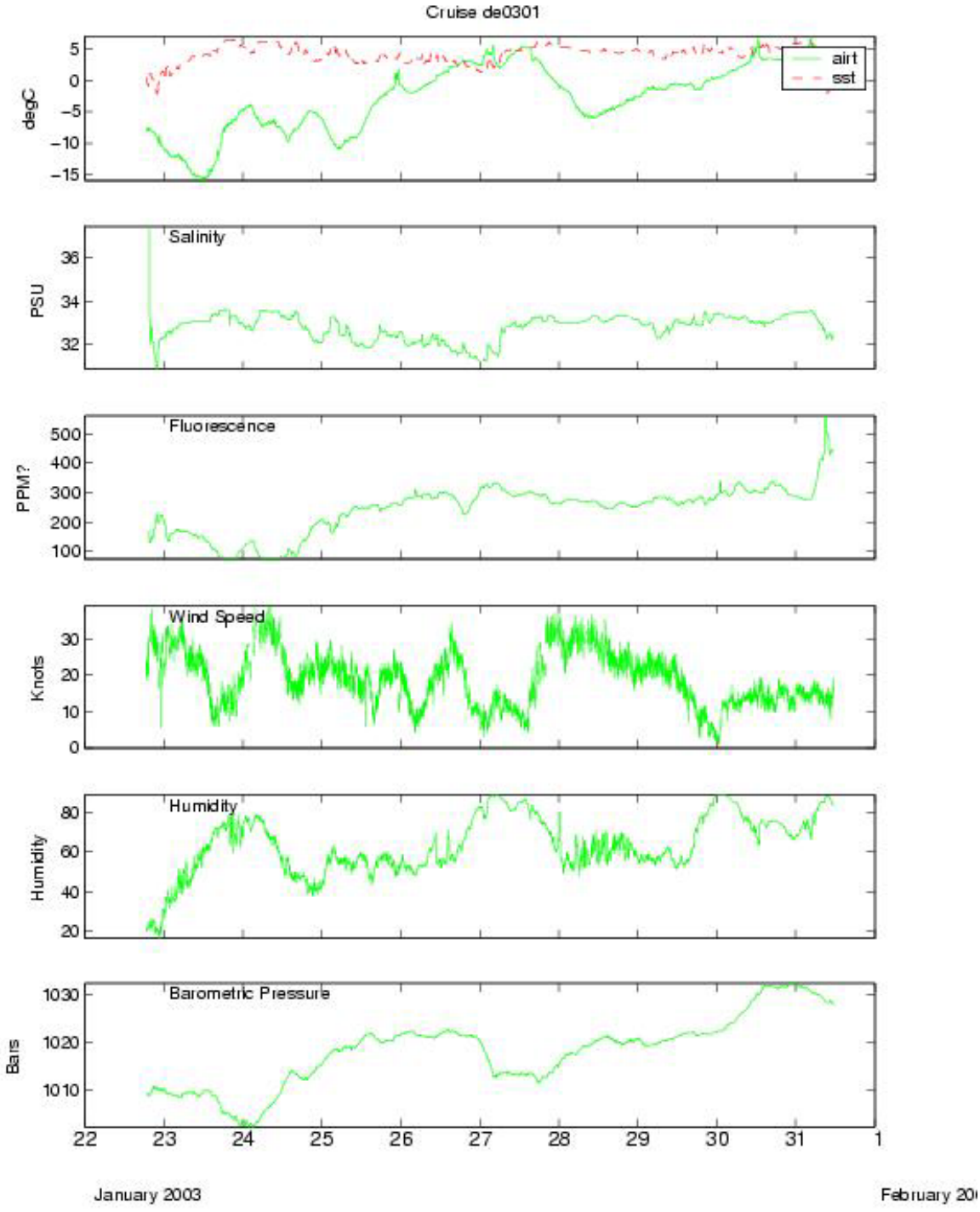
Cruise Objectives: To monitor the recovery of the benthic habitat in the closed areas.

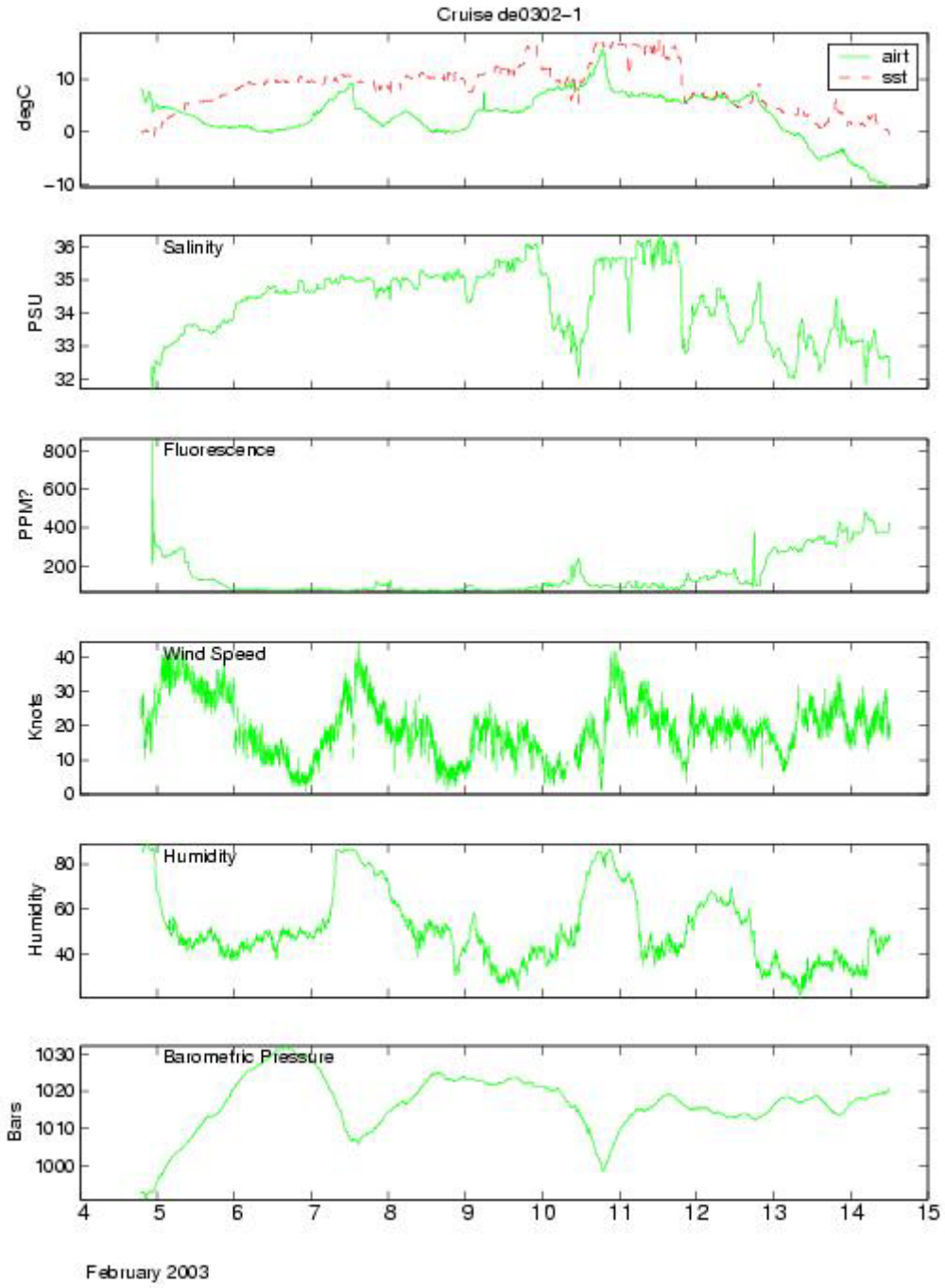
Ecosystem Monitoring

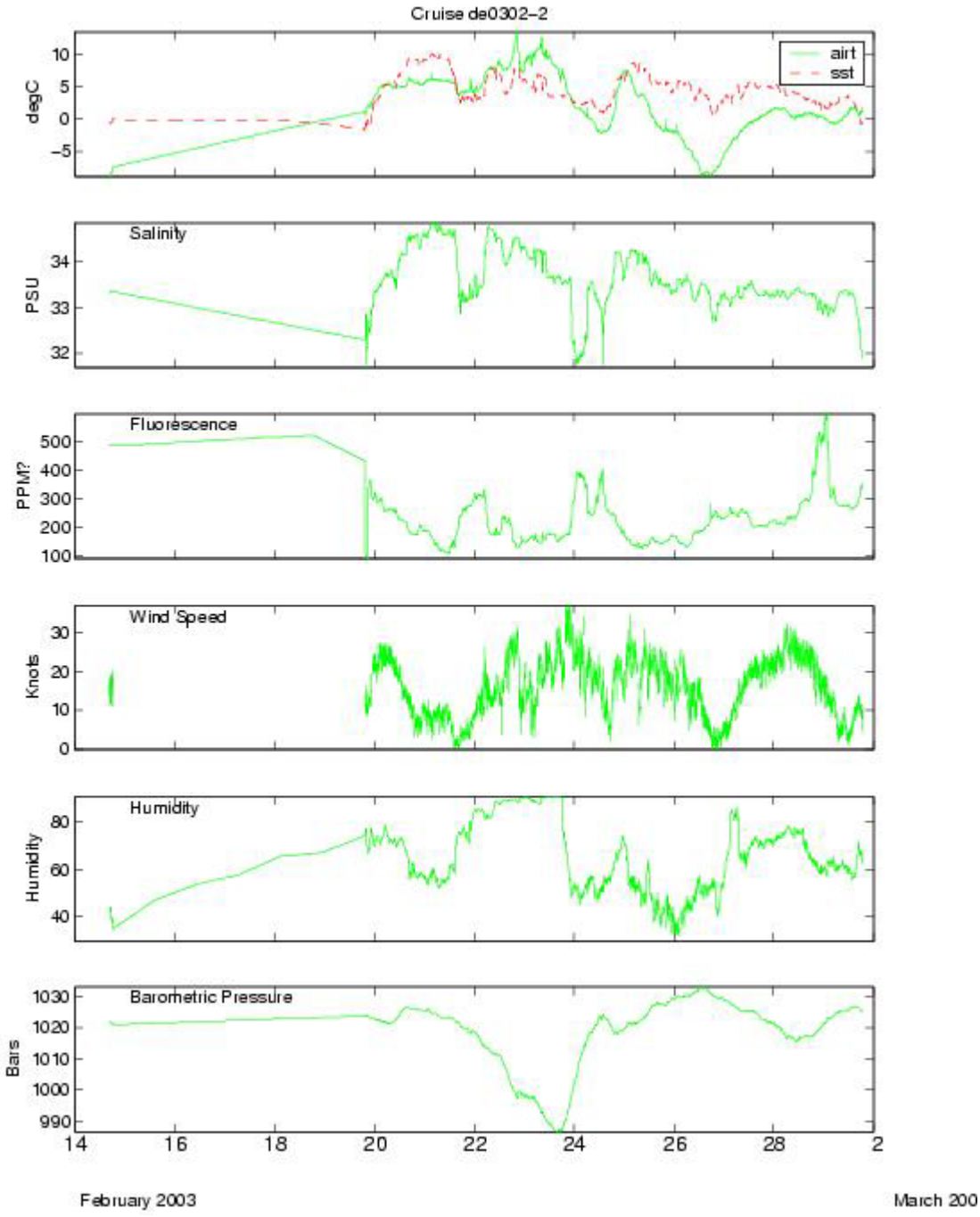
Cruise:	ALB0306
Vessel:	R/V Albatross IV
Dates:	3 – 12 November
Sea Days:	10
Instrument(s):	1496
Total # of stations:	70
# of vertical CTD/Profiler casts:	4
# of double oblique Profiler casts:	71
# Salinity samples:	13
Salt correction:	+0.007

Cruise Objectives: To assess the impact of changing biological and physical properties of the Northeast Continental Shelf ecosystem which influence the sustainable productivity of the living marine resources.

Appendix B. Time series plots of hull mounted sensor records.


Cruise de0301
degC
airt
sst
Salinity
PSU
Fluorescence
PPM?
Wind Speed
Knots
Humidity
Humidity
Barometric Pressure
Bars
January 2003
February 20


Cruise de0302-1
airt
sst
degC
10
0
−10
Salinity
PSU
36
35
34
33
32
Fluorescence
PPM?
800
600
400
200
Wind Speed
Knots
40
30
20
10
0
Humidity
Humidity
80
60
40
Barometric Pressure
Bars
1030
1020
1010
1000
4
5
6
7
8
9
10
11
12
13
14
15
February 2003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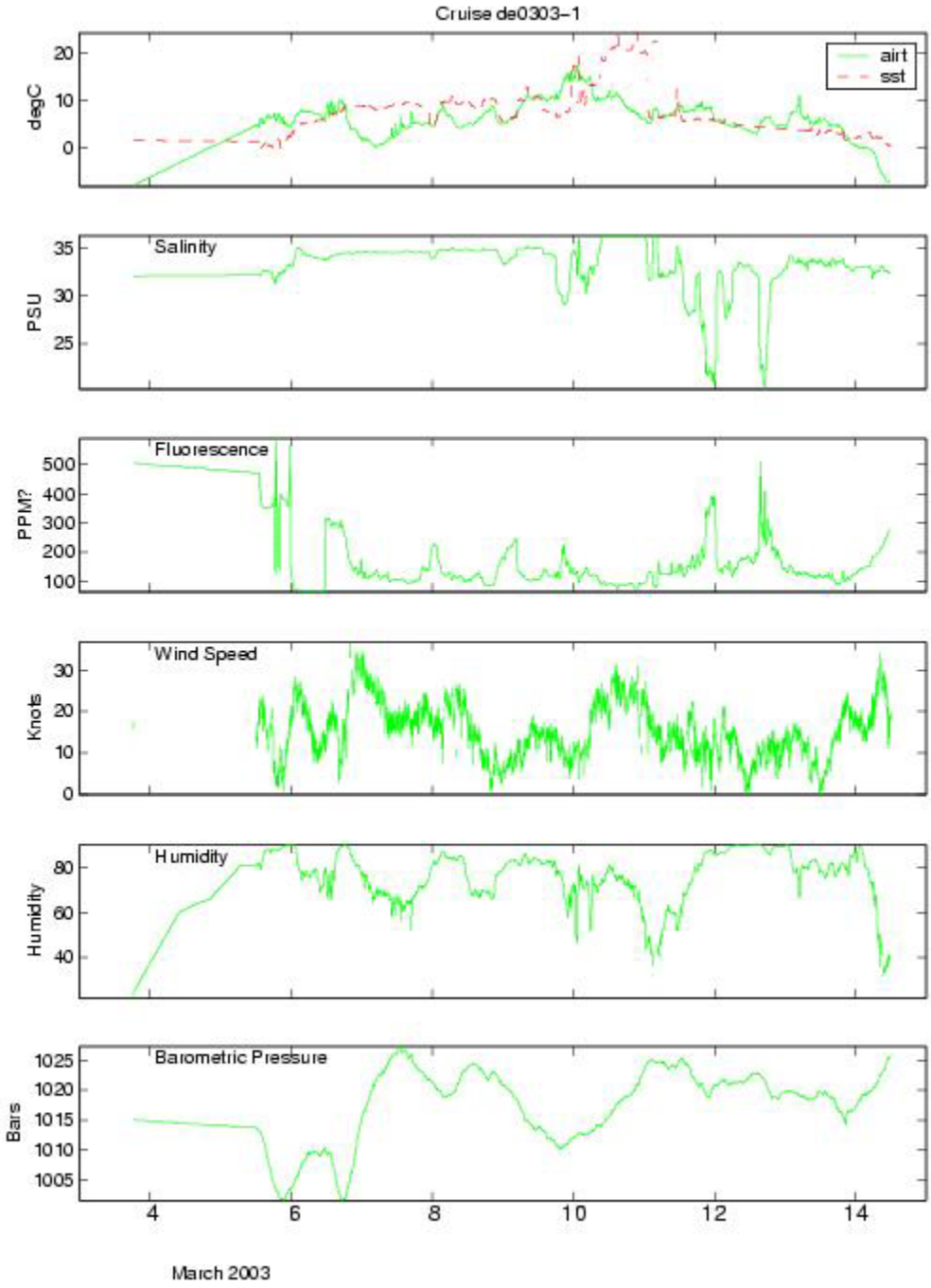
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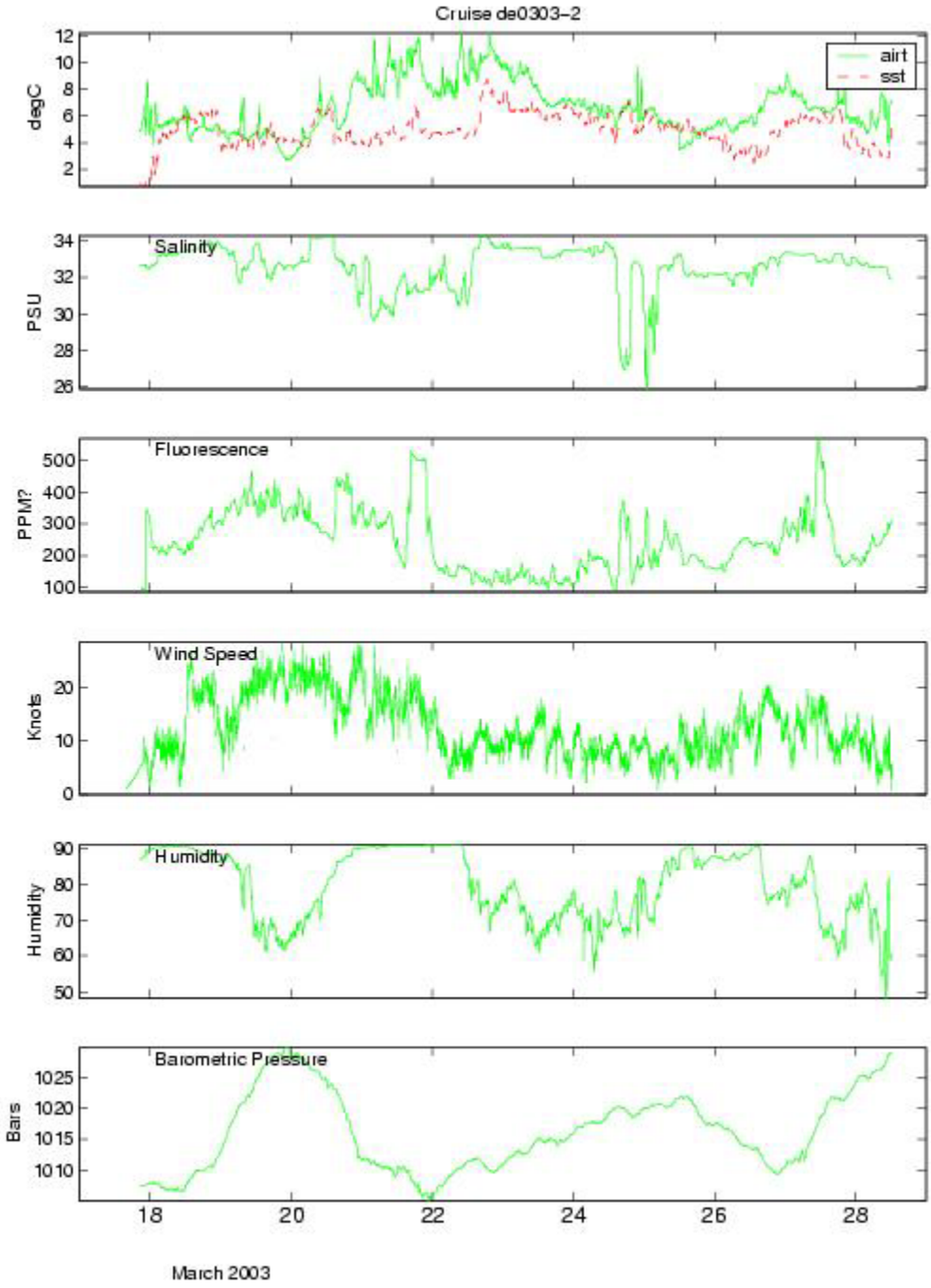
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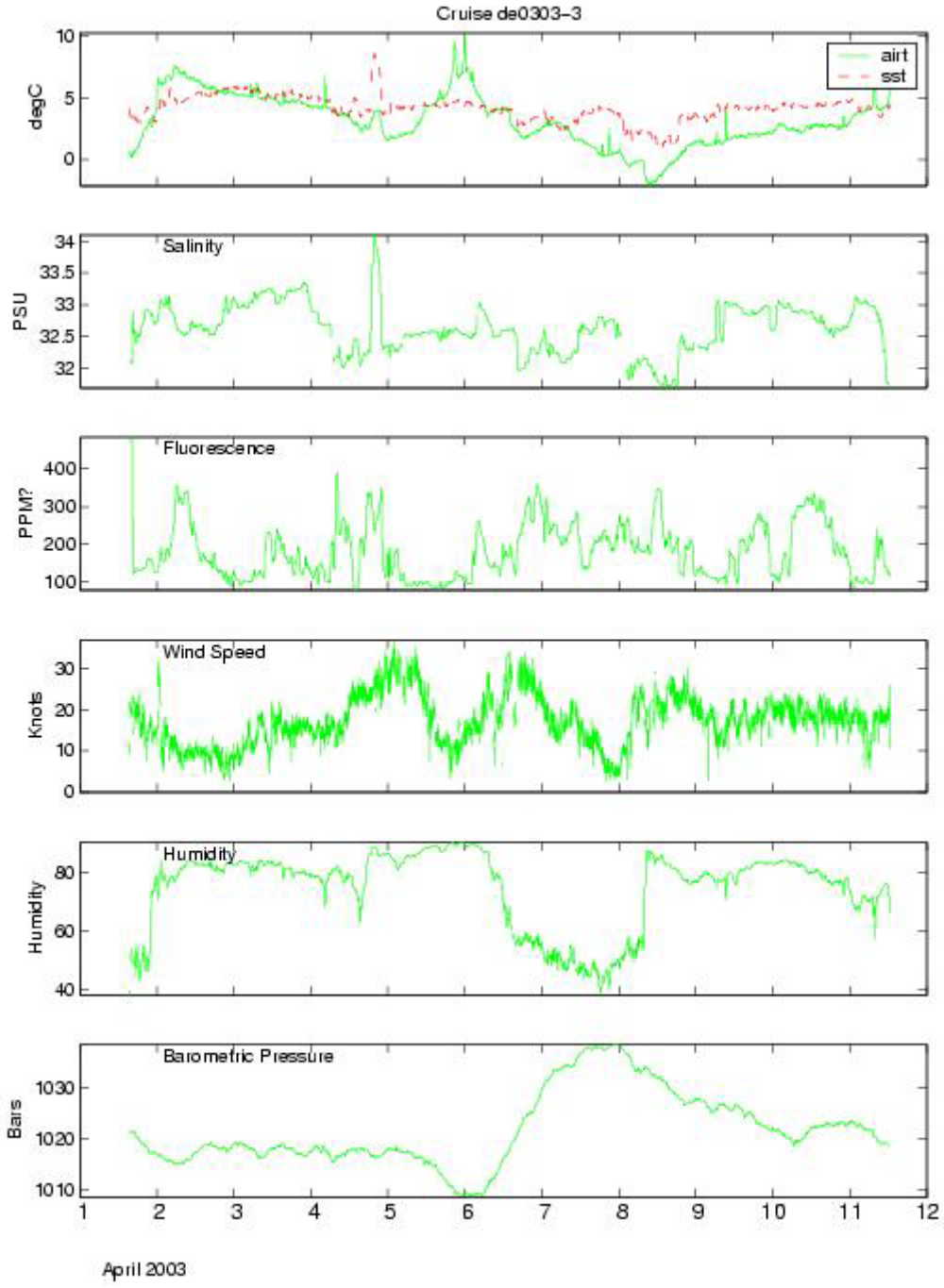
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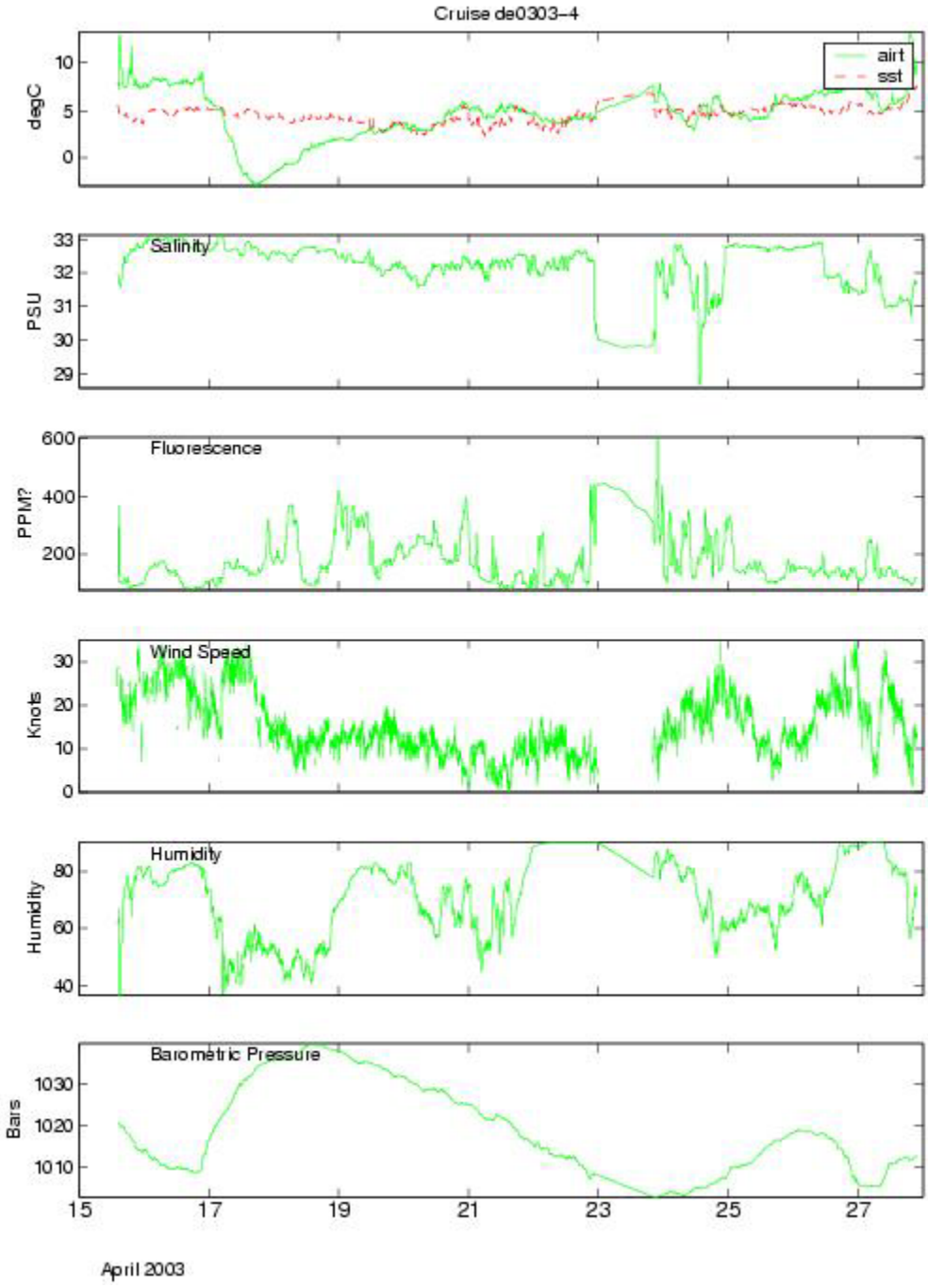
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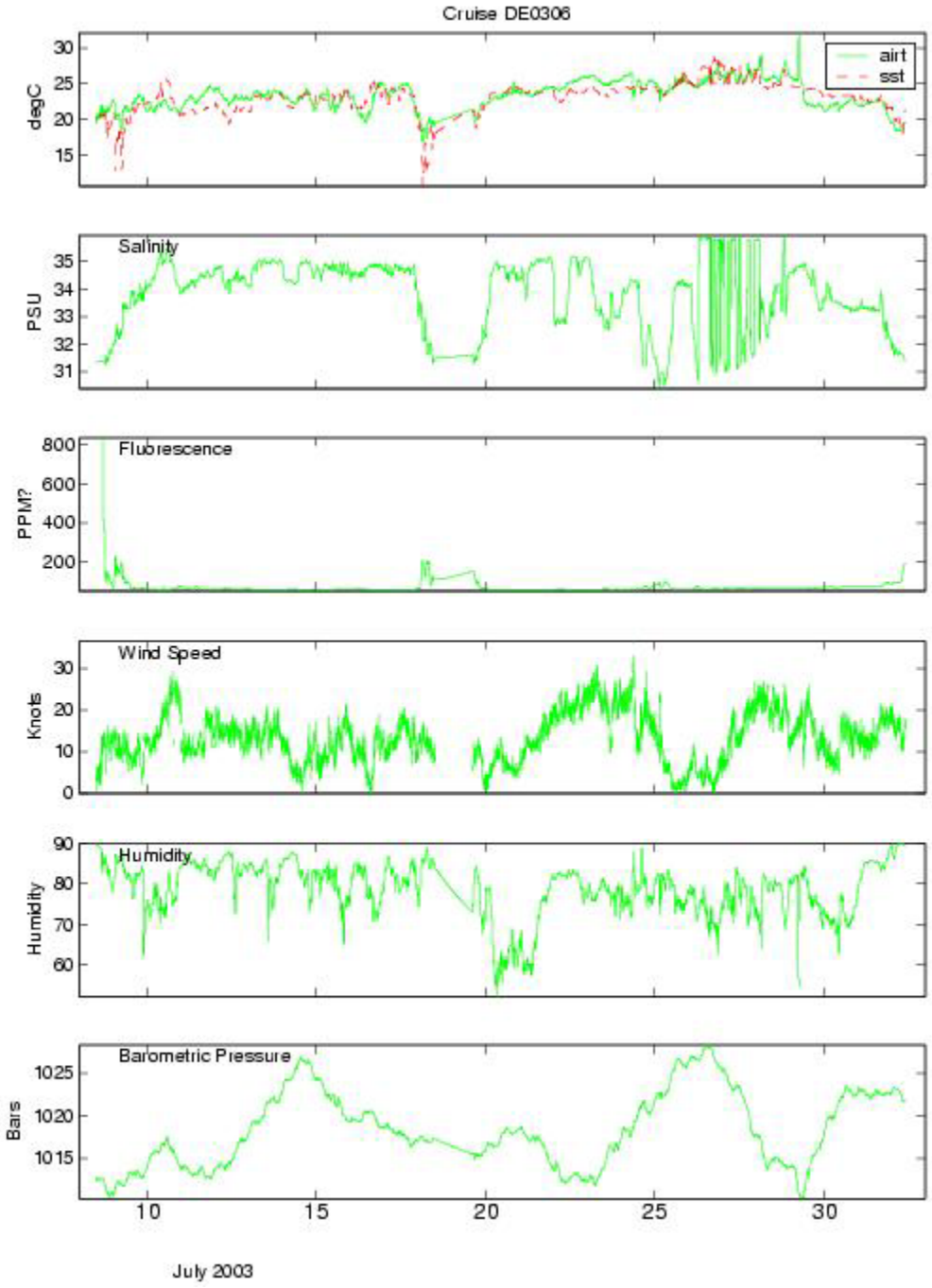
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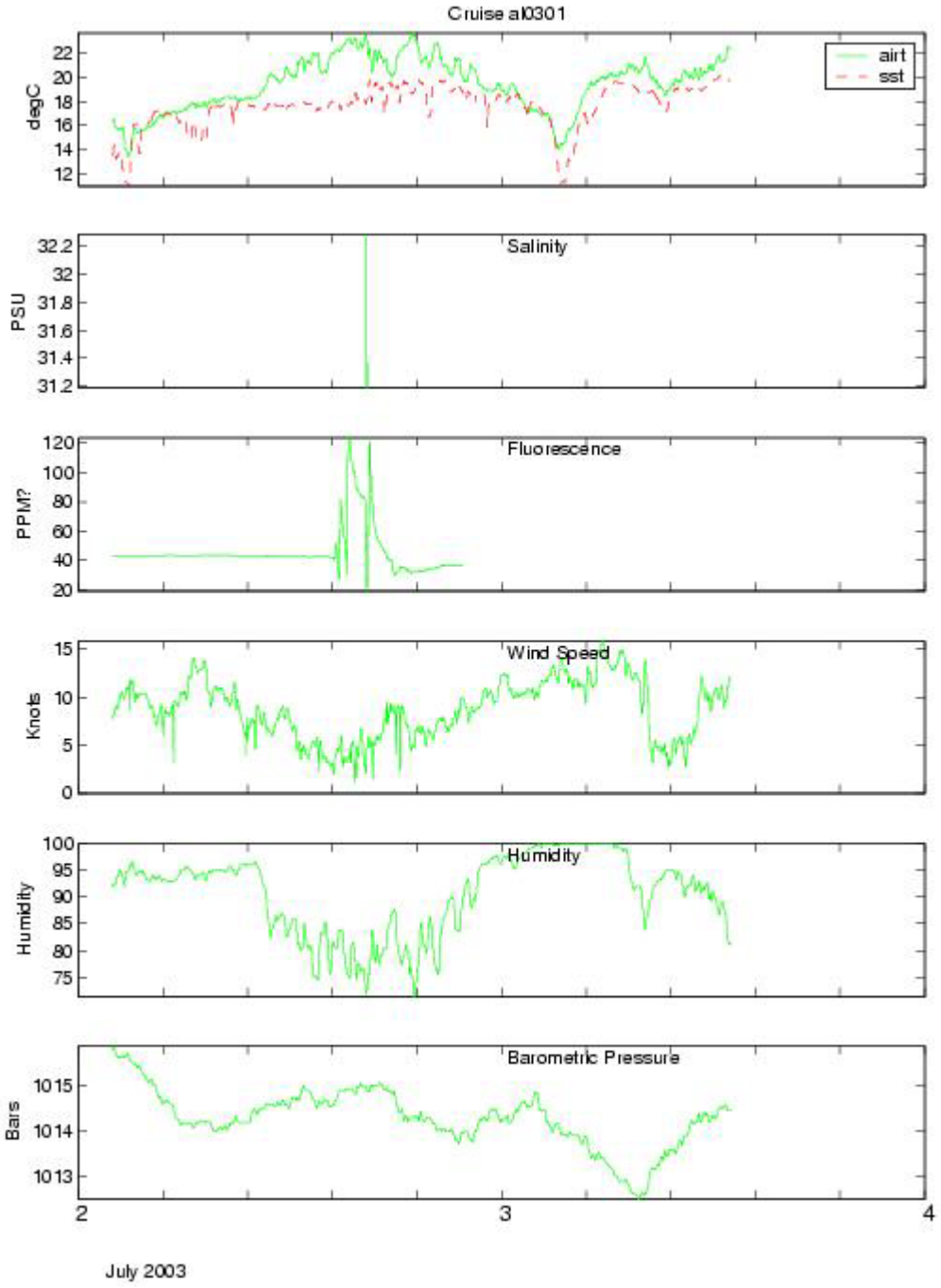
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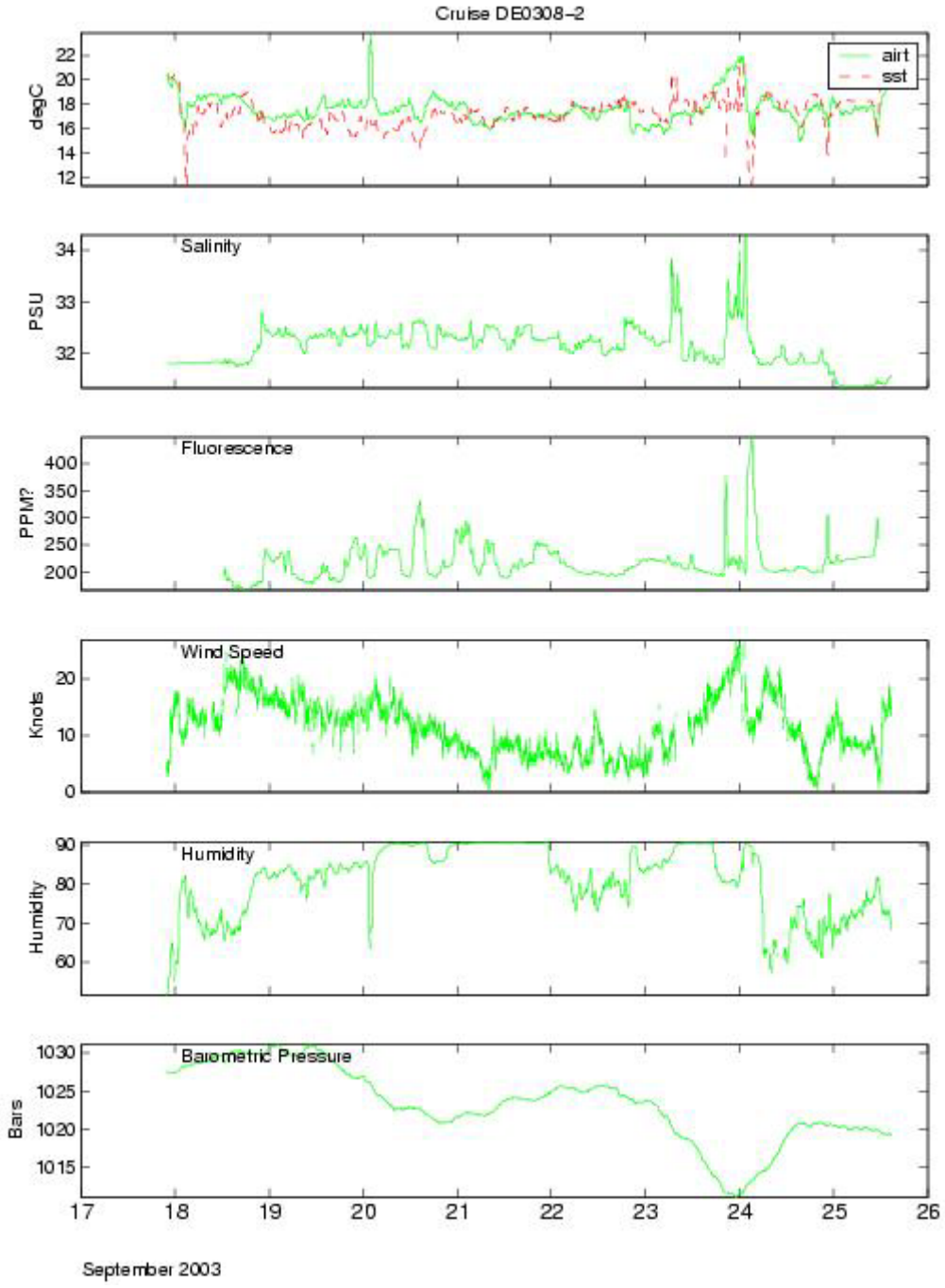
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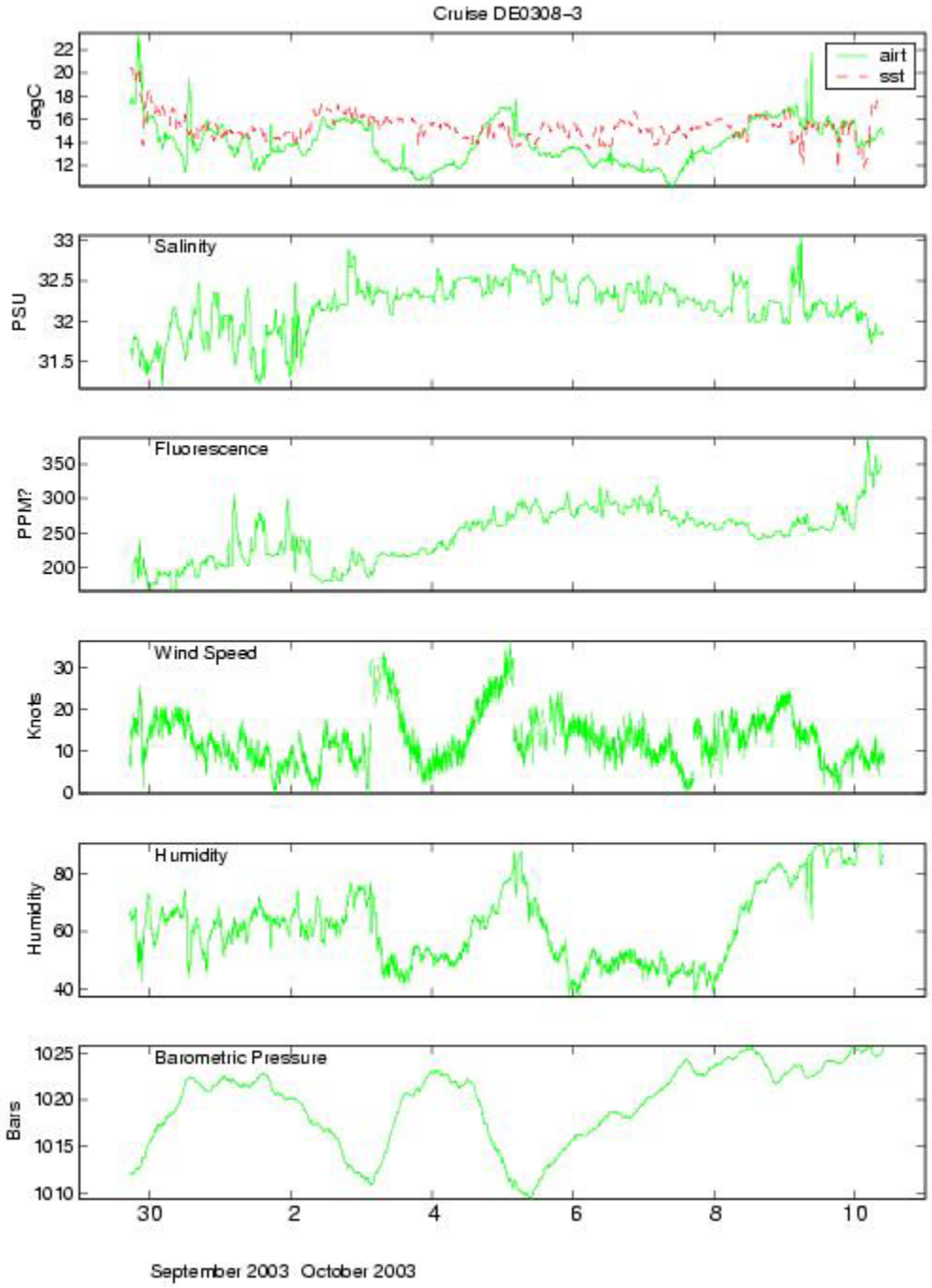
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Wind Speed
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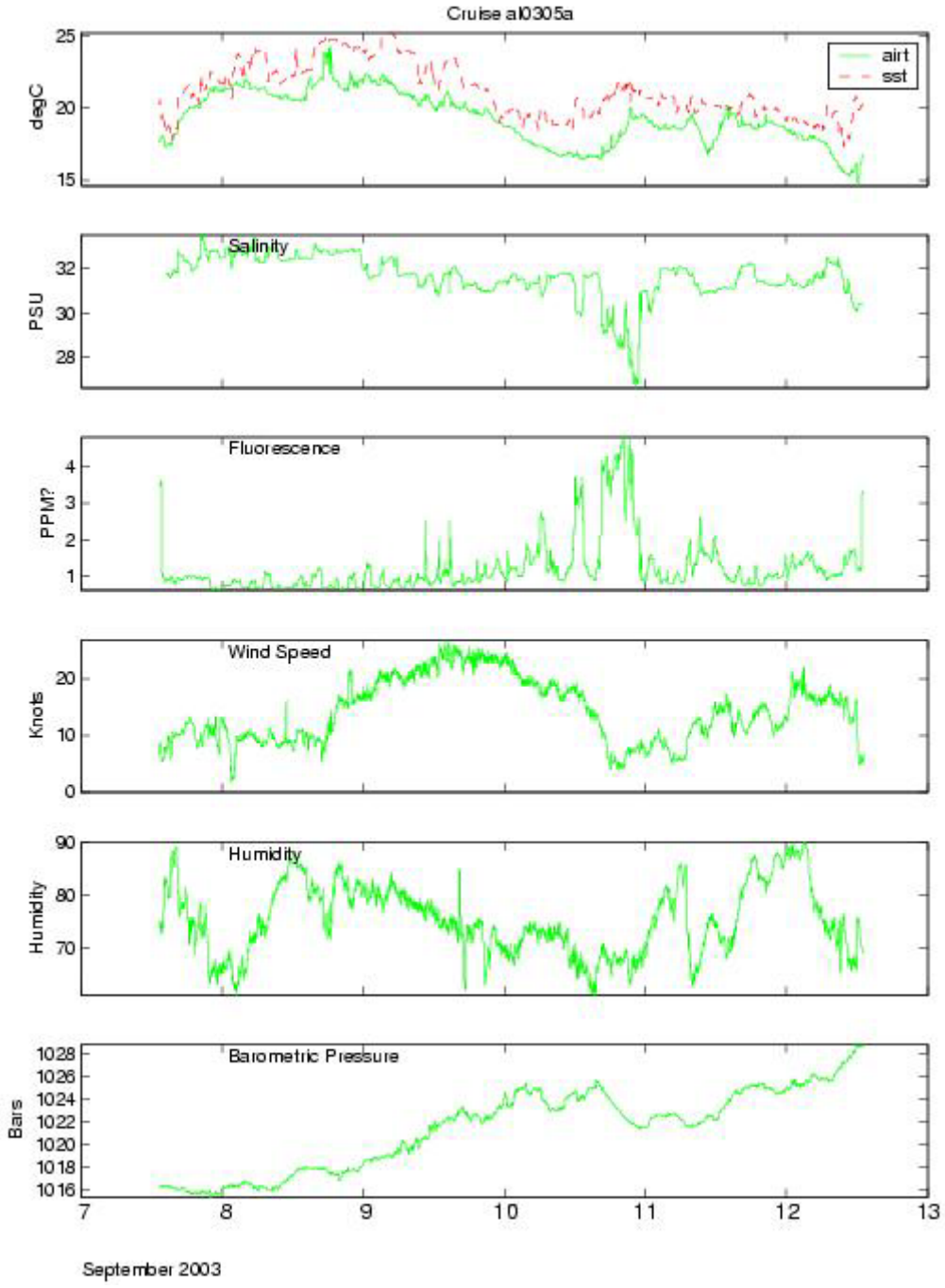
September 2003 October 2003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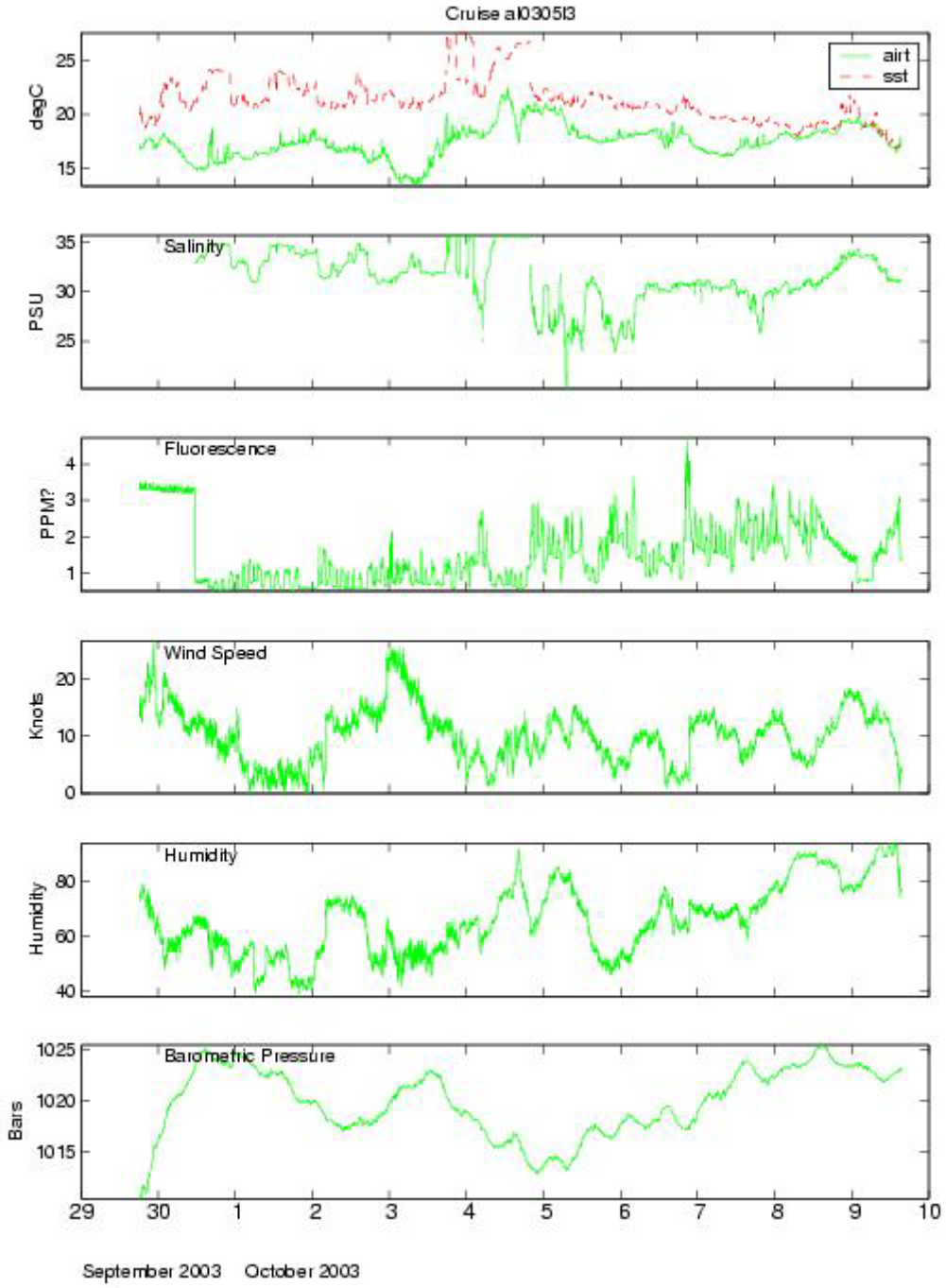
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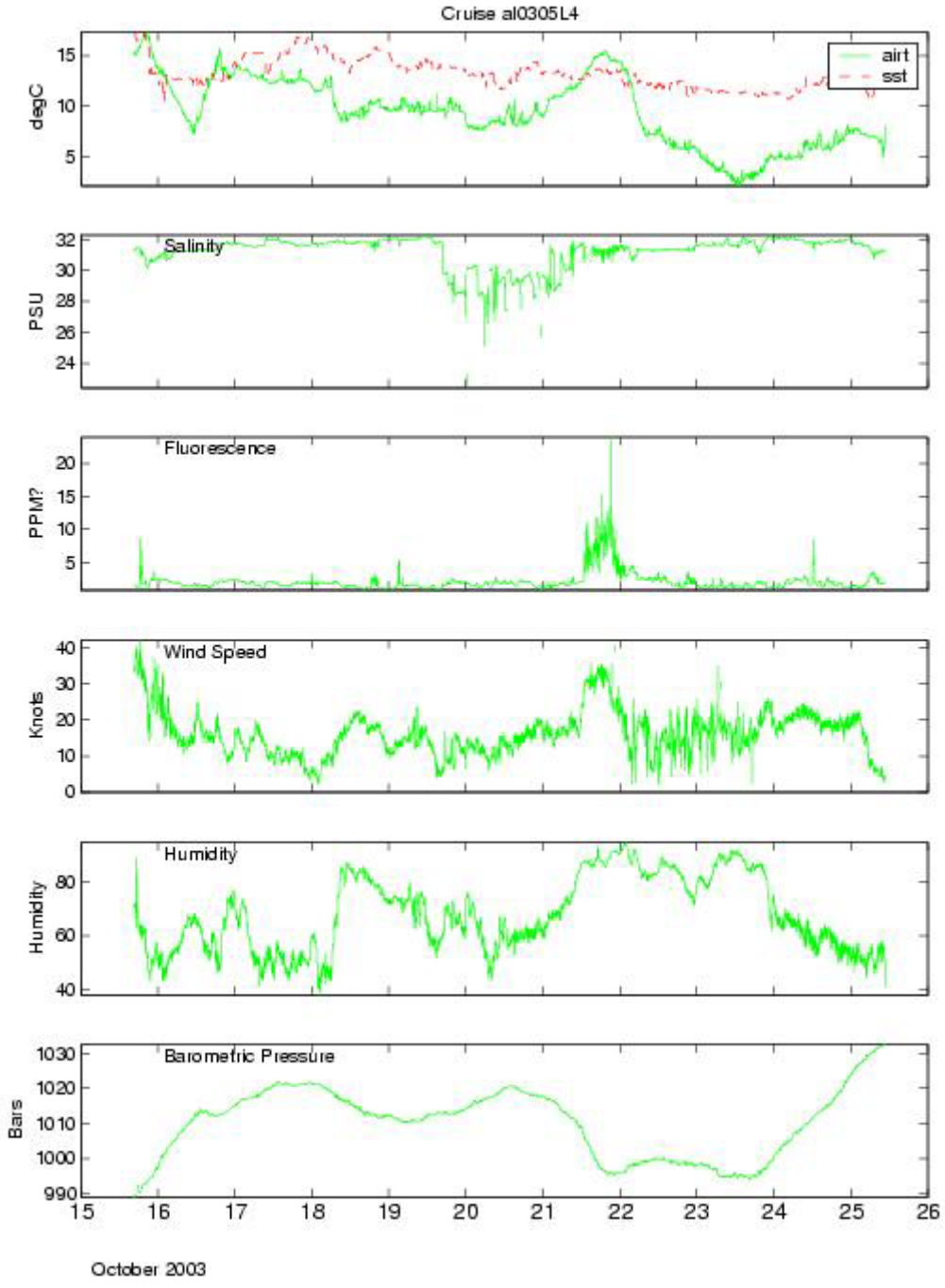
October 2003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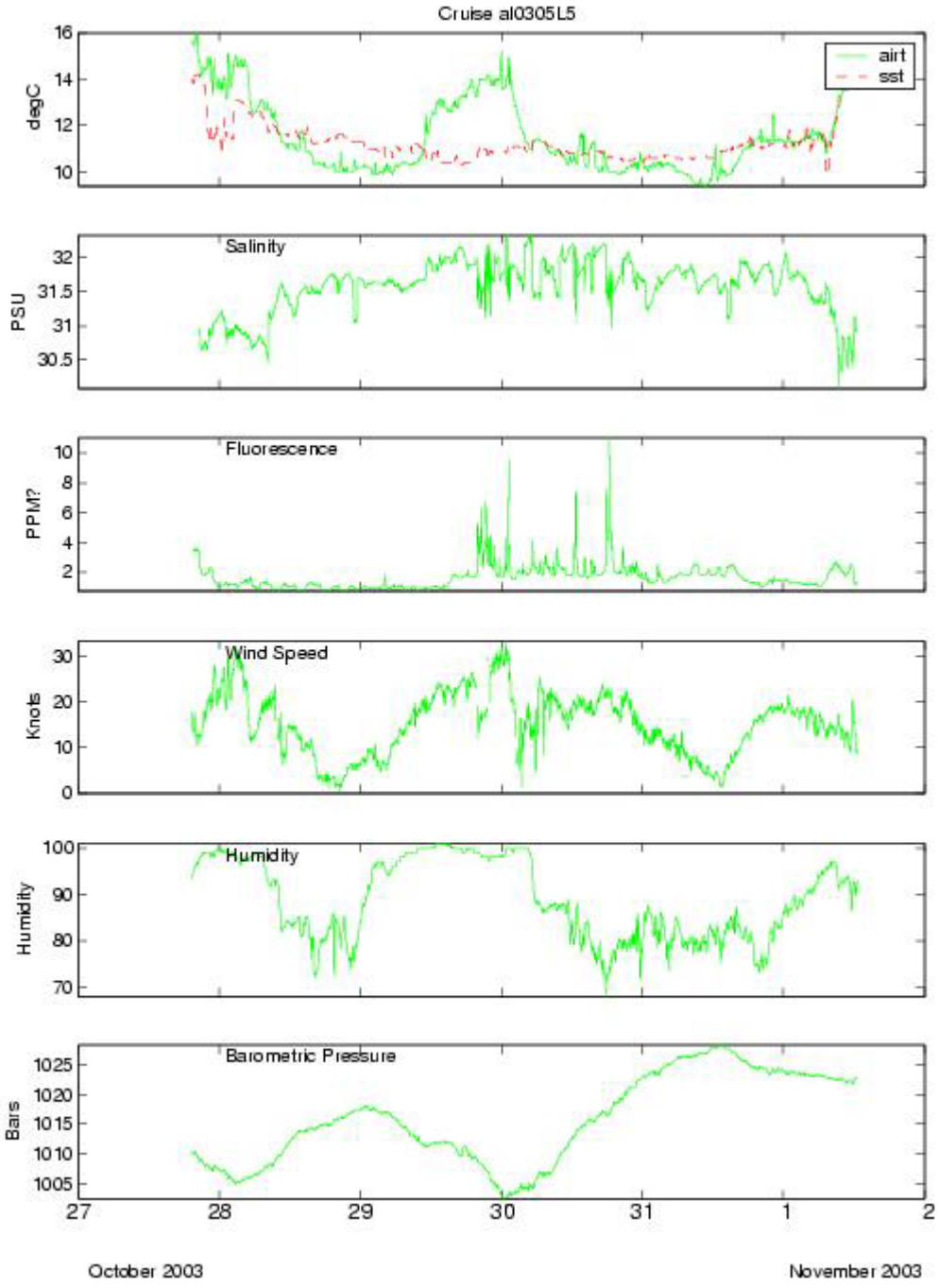
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November 2003

Appendix C. Areal average surface and bottom temperature, salinity, and anomalies presented by cruise using hydrographic data collected in 2003.

Table C1. Areal average surface and bottom temperature and temperature anomalies for the 2003 NEFSC cruises in the five regions of the northeast continental shelf as shown in Figure 1.

		SURFACE					BOTTOM				
CRUISE	CD	#obs	Temp	Anomaly	SDV1	SDV2	#obs	Temp	Anomaly	SDV1	SDV2 (1)
Gulf of Maine West											
DEL0301	25	21	5.02	-1.00	0.24	1.22	19	6.96	0.63	0.21	1.10
DEL0303	111	50	4.84	-0.60	0.16	0.77	49	5.03	0.01	0.14	0.74
DEL0305	148	11	8.92	-0.83	0.34	0.80*	10	5.95	-0.09	0.30	0.48*
ALB0301	221	17	17.42	1.35	0.28	1.88*	17	6.61	-1.12	0.25	1.63*
ARM0301	238	43	17.47	1.48	0.22	0.99*	14	7.30	-0.23	0.26	1.26*
DEL0308	266	47	16.58	1.25	0.15	1.30*	47	6.32	-0.03	0.13	0.69*
ALB0305	296	46	12.00	0.04	0.17	1.27	45	7.17	-0.04	0.15	1.16
ALB0306	316	7	9.88	-0.04	0.42	0.58*	5	7.84	0.38	0.42	0.19*
Gulf of Maine East											
DEL0301	26	13	3.33	-2.08	0.23	1.13	9	7.22	0.29	0.29	1.27
DEL0303	105	31	3.61	-1.00	0.17	0.70	29	6.44	-0.18	0.18	0.87
DEL0305	148	13	6.60	-1.30	0.27	0.86*	12	7.32	0.41	0.31	0.93*
ARM0301	237	16	15.22	0.41	0.20	2.23	9	8.63	0.23	0.27	1.77
ALB0301	237	7	16.66	1.92	0.36	1.36*	7	9.24	-3.13	0.34	2.77*
DEL0308	262	39	16.05	1.13	0.16	1.17*	38	8.24	0.34	0.15	1.46*
ALB0305	298	33	11.71	-0.26	0.17	0.49	30	8.75	0.11	0.19	1.80
ALB0306	315	8	11.27	0.02	0.35	0.56*	6	8.82	0.38	0.40	1.51*
Georges Bank											
DEL0301	29	22	5.07	-0.60	0.21	0.58*	19	5.14	-0.82	0.23	1.03*
DEL0303	96	50	4.40	-0.52	0.15	0.91	44	4.66	-0.38	0.17	0.93
DEL0305	146	29	8.49	-0.02	0.23	2.03	27	7.99	0.52	0.25	1.71
ARM0301	234	37	17.77	1.97	0.18	1.83*	26	11.83	-0.96	0.19	1.70*
ALB0301	236	58	17.56	1.69	0.15	2.09	57	10.50	-1.10	0.16	2.04
DEL0308	264	46	15.90	0.77	0.15	1.14*	46	13.26	0.44	0.15	2.84*
ALB0305	276	45	17.35	2.09	0.15	2.38	38	12.09	-0.43	0.19	1.92
DEL0310	307	15	13.39	0.40	0.27	0.43*	15	12.52	0.16	0.25	1.00*
ALB0306	312	33	13.38	0.59	0.18	0.72	24	12.35	0.37	0.21	1.02
MAB North											
DEL0302	57	27	4.67	-0.48	0.26	1.04*	17	3.78	-0.95	0.31	2.06*
DEL0303	86	53	5.21	0.60	0.20	0.84	49	4.30	-1.64	0.23	2.13
ALB0301	224	19	22.56	2.45	0.29	2.02*	19	9.45	0.94	0.28	1.46*
ALB0305	259	55	20.64	1.70	0.18	2.05	51	12.94	1.26	0.21	2.78
ALB0306	309	26	14.98	0.77	0.26	0.53	21	12.96	-0.12	0.31	0.98
MAB South											
DEL0302	47	57	7.11	0.63	0.17	1.77	39	6.92	0.80	0.23	2.02
DEL0303	75	69	6.56	0.52	0.16	1.80	63	5.89	0.05	0.18	1.95
ALB0301	214	55	23.00	-0.34	0.18	2.29*	55	7.95	-0.03	0.19	1.38*
ALB0305	268	79	21.38	0.51	0.15	1.24	70	15.10	0.99	0.18	2.17
ALB0306	308	5	15.90	1.06	0.57	0.81*	2	13.30	0.65	-9.99	-9.99*

(1) "CRUISE", the code name for a cruise: "CD", the calendar mid-data of all the stations within a region for a cruise: "# obs", the number of observations included in each average: "Temp", the areal average temperature: "Anomaly", the areal average temperature anomaly: "SDV1", the standard deviation associated with the average temperature anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived.

(*) A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

Table C2. Areal average surface and bottom salinity and salinity anomalies for the 2003 NEFSC cruises in the five regions of the northeast continental shelf as shown in Figure 1.

		SURFACE					BOTTOM				
CRUISE	CD	#obs	Salt	Anomaly	SDV1	SDV2	#obs	Salt	Anomaly	SDV1	SDV2 (1)
Gulf of Maine West											
DEL0301	26	4	33.43	0.43	0.30	0.10*	4	33.47	0.23	0.25	0.17*
DEL0303	111	37	32.67	0.19	0.12	0.52	49	33.30	-0.04	0.08	0.28
DEL0305	148	11	32.70	0.24	0.21	0.30*	10	33.71	-0.07	0.17	0.14*
ALB0301	221	8	31.88	-0.20	0.22	0.15*	12	32.73	-0.03	0.16	0.20*
ARM0301	238	42	32.06	-0.06	0.14	0.20*	14	33.56	0.07	0.14	0.18*
DEL0308	266	46	32.19	-0.03	0.10	0.22*	47	33.72	-0.07	0.08	0.26*
ALB0305	296	44	32.51	-0.02	0.11	0.21	45	33.62	0.05	0.09	0.21
ALB0306	316	7	32.56	-0.05	0.28	0.10*	5	33.45	0.09	0.22	0.06*
Gulf of Maine East											
DEL0303	105	24	32.22	-0.25	0.13	0.39	29	33.80	-0.11	0.09	0.33
DEL0305	148	13	32.38	-0.03	0.20	0.24*	12	34.00	0.12	0.17	0.19*
ARM0301	237	16	32.51	0.12	0.14	0.31	9	34.39	0.11	0.14	0.38
ALB0301	237	7	32.33	-0.17	0.21	0.12*	7	32.76	0.09	0.21	0.14*
DEL0308	262	38	32.44	-0.03	0.11	0.19*	38	34.72	0.17	0.08	0.22*
ALB0305	298	33	32.80	0.16	0.12	0.33	30	34.40	0.13	0.10	0.27
ALB0306	315	8	32.76	0.12	0.23	0.08*	6	34.51	0.55	0.25	0.72*
Georges Bank											
DEL0301	29	11	33.21	0.31	0.18	0.16*	10	33.24	0.22	0.18	0.35*
DEL0303	96	44	32.45	-0.51	0.09	0.49	44	32.71	-0.43	0.10	0.41
DEL0305	146	29	32.92	0.06	0.13	0.66	27	33.13	0.00	0.15	0.46
ARM0301	234	36	32.36	-0.29	0.11	0.23*	25	32.71	-0.05	0.11	0.32*
ALB0301	236	55	32.34	-0.31	0.09	0.33	57	32.90	-0.01	0.09	0.27
DEL0308	264	45	32.49	0.00	0.08	0.18*	46	32.70	0.06	0.08	0.20*
ALB0305	276	45	32.89	0.19	0.09	0.62	38	32.79	-0.17	0.11	0.33
DEL0310	307	14	32.70	-0.06	0.16	0.10*	15	32.91	0.05	0.15	0.25*
ALB0306	312	33	32.75	0.00	0.11	0.22	24	32.99	-0.01	0.13	0.48
MAB North											
DEL0302	57	22	33.48	0.40	0.19	0.42*	17	33.39	0.07	0.18	0.69*
DEL0303	86	52	32.83	-0.02	0.13	1.03	48	33.17	-0.31	0.14	0.62
ALB0301	224	15	31.46	-0.46	0.21	0.69*	19	33.31	0.26	0.17	0.40*
ALB0305	259	54	32.66	0.12	0.12	1.49	51	33.17	-0.18	0.13	0.57
ALB0306	309	26	33.06	0.03	0.17	0.52	21	33.75	0.25	0.19	0.41
MAB South											
DEL0302	47	52	34.10	0.47	0.14	0.52	38	34.28	0.56	0.14	0.40
DEL0303	75	64	33.03	0.04	0.13	1.99	62	33.55	0.14	0.11	1.52
ALB0301	214	52	31.34	-0.66	0.13	0.57*	55	33.51	0.10	0.11	0.48*
ALB0305	268	77	31.92	-0.45	0.11	1.57	70	32.71	-0.38	0.11	1.02
ALB0306	308	5	33.34	0.01	0.40	0.56*	2	33.75	0.98	-9.99	-9.99*

(1) "CRUISE", the code name for a cruise: "CD", the calendar mid-data of all the stations within a region for a cruise: "# obs", the number of observations included in each average: "Salt", the areal average salinity: "Anomaly", the areal average salinity anomaly: "SDV1", the standard deviation associated with the average salinity anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived.

(*) A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

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The mission of NOAA's National Marine Fisheries Service (NMFS) is "stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment." As the research arm of the NMFS's Northeast Region, the Northeast Fisheries Science Center (NEFSC) supports the NMFS mission by "conducting ecosystem-based research and assessments of living marine resources, with a focus on the Northeast Shelf, to promote the recovery and long-term sustainability of these resources and to generate social and economic opportunities and benefits from their use." Results of NEFSC research are largely reported in primary scientific media (*e.g.*, anonymously-peer-reviewed scientific journals). However, to assist itself in providing data, information, and advice to its constituents, the NEFSC occasionally releases its results in its own media. Currently, there are three such media:

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Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab studies; progress reports on experiments, monitoring, and assessments; background papers for, collected abstracts of, and/or summary reports of scientific meetings; and simple bibliographies. Issues receive internal scientific review, but no technical or copy editing.

Resource Survey Report (formerly *Fishermen's Report*) -- This information report is a quick-turnaround report on the distribution and relative abundance of selected living marine resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. There is no scientific review, nor any technical or copy editing, of this report.

OBTAINING A COPY: To obtain a copy of a *NOAA Technical Memorandum NMFS-NE* or a *Northeast Fisheries Science Center Reference Document*, or to subscribe to the *Resource Survey Report*, either contact the NEFSC Editorial Office (166 Water St., Woods Hole, MA 02543-1026; 508-495-2228) or consult the NEFSC webpage on "Reports and Publications" (*http://www.nefsc.noaa.gov/nefsc/publications/*).